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CIRCULAR NO. 166

U. S. Naval Observatory, Washington, D. C. 20390 May 1, 1983

ANNULAR SOLAR ECLIPSE OF 30 MAY 1984

by

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and

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It is a continuing policy of the Nautical Almanac Office to prepare issues of the series of Naval Observatory *Circulars* containing detailed information for observing most total solar eclipses and some annular solar eclipses. This is a service to the international scientific community, based on agreements with Commissions and Working Groups of the International Astronomical Union.

The target date for distribution is one year in advance of the event. The distribution is done by the staff of the Nautical Almanac Office. As a regular publication of the Naval Observatory, distribution is made to institutions with which the Observatory has exchange agreements or other obligation. No other mailing list or request file is maintained. Users must make a new written request for each eclipse *Circular*, no more than 12—14 months in advance. There is no charge for a single copy; bulk rates will be quoted upon written request to the Director of the Nautical Almanac Office.

The content and layout of the eclipse *Circulars* is being reviewed and revised. Users' comments are solicited, on useful features to be continued as well as suggestions for changes or additions.

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SUPPLEMENT TO CIRCULAR 166

ANNULAR SOLAR ECLIPSE OF 30 MAY 1984

David Herald did send a chart for applying limb corrections to contact times, but it arrived after the Circular had gone to press. The magnitude of this eclipse is so nearly unity that interpretation of the chart is more complex than usual and requires careful study. In particular, the information given here extends the discussion of Limb Corrections on page 8, and modifies the description of the phenomena to be observed on page 9.

There are three rings drawn: a broken heavy inner ring, a thin middle ring, and a continuous heavy outer ring. The thin ring represents the mean smooth lunar limb corresponding to the broken circle in the Limb Profile on page 11, and contact times in the Circular refer to this smooth limb. To correct for the true rough limb, the outer heavy ring, at any given position angle of contact, represents the *solar* limb when it just clears the highest lunar mountains in the vicinity of that position angle. Similarly, the inner broken ring represents, for any given position angle of contact, the *solar* limb when it just touches the lowest valley bottoms in the vicinity of the position angle. These two rings, both representing the solar limb, must be of quite different size because of the exaggerated radial scale of the profile.

In examining the phenomena associated with this eclipse, we must now consider the west limbs at second contact separately from the east limbs at third contact. On the west, at second contact, the partial phase ends when the growing solar crescent, which appears to be enveloping the trailing lunar limb, reaches the lowest valley bottom in the vicinity of the contact and a string of Baily's Beads forms between the cusps of the closing annulus. The ensuing phase may be called "partial annularity", and continues until the solar limb has cleared the highest lunar mountain in the vicinity of the contact point, the Beads have all merged into the annulus, and the annular phase begins.

On the east, at third contact, the annular phase ends when the advancing lunar mountain peaks break the annulus, and a string of Beads forms between the cusps of the now shrinking crescent. This phase of "partial annularity" continues until the solar limb has sunk below the lowest valley bottoms in the vicinity of the contact, all the Beads disappear, and the concluding partial phase ensues.

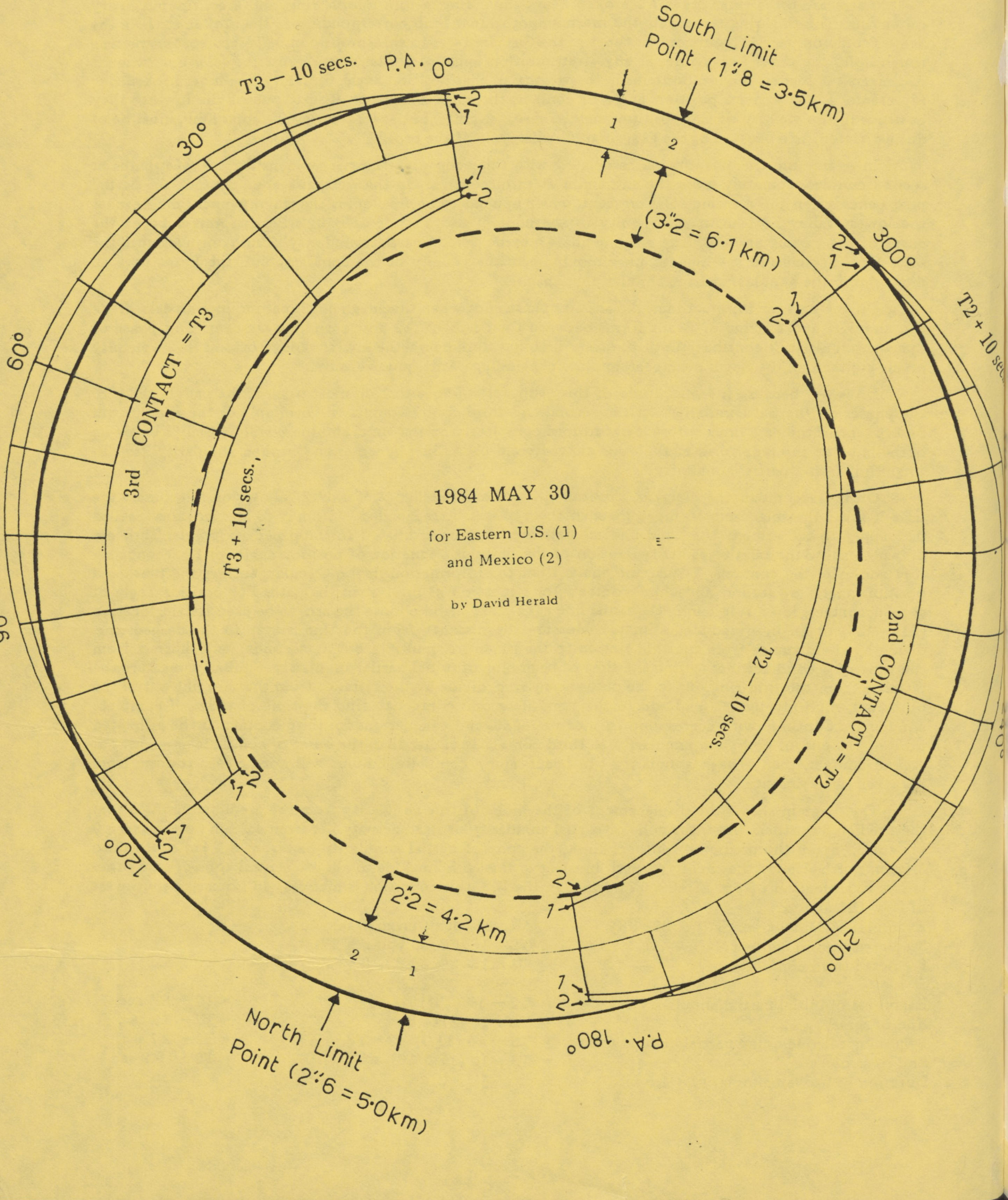
However, because the magnitude of this eclipse is so close to 1, in most parts of the path in the U.S. the phases of "partial annularity" at the second and third contact points will overlap, i.e., the annulus will be broken on the east limb before it has formed completely on the west, and there will be Baily's Beads on both limbs of the lunar disk at the same time. Herald calls this phenomenon "broken annularity" to distinguish it from "partial annularity".

On the accompanying diagram, the four pairs of arcs labelled "1" and "2" allow you to estimate the time it takes the solar limb to move through these phases. Arcs labelled "1" apply to Mexico; arcs labelled "2" apply to the eastern U.S., and intermediate arcs may be estimated for intermediate points. They are drawn to show the relative radial separation of the limbs as a function of position angle for 10 seconds before and after the contacts. To use the chart, from the information in the Circular, extract the times and position angles of second and third contacts for a location of interest in the path. For position angle of second contact, lay a ruler along the radial line at that angle and choose the arcs to be used for the location ("1", "2", or an intermediate estimate). Measure the distance from the thin ring in to the dashed ring, divide by the distance from the thin ring in to the inner arc, multiply by 10 (seconds), and subtract from the time of second contact to find the time of beginning of initial partial annularity. Similarly, measure the distance from the thin ring out to the outer heavy ring, divide by the distance from the thin ring out to the outer arc, multiply by 10, and add to the time of second contact to find the time of onset of complete annularity. Continue with corresponding measurements and calculations for third contact. If the estimated time of the end of complete annularity at third contact is earlier than the onset of complete annularity at second contact, then broken annularity will occur, and a complete annulus will not be seen to form from the given observing site.

The diagram shows the displacement of the limits of true annularity from the predicted limits. From the predicted northern limit, the zone of partial annularity or Bead activity lies from 4.2 km north in to 5.0 km south. From the predicted southern limit, the zone of partial annularity lies from 6.1 km south in to 3.5 km north. Hence the predicted path must be at least 8.5 km wide to allow a central zone of true annularity. Examination of pp. 28—29 shows that in the U.S. this condition is met only in Louisiana southwest of New Orleans.

Example: Atlanta, Georgia (pp. 32—33)	Measurements given in mm.		
Predicted second contact:	T2 = 16 22 50.6, P = 271.		
Predicted third contact:	T3 = 16 22 59.6, P = 36.		T3 = T2 + 9.0 sec.
Beginning of initial partial annularity:	= T2 — 10 (13/15)		= T2 — 8.7 sec.
End of same	= T2 + 10 (9/14.5)		= T2 + 6.2 sec.
Beginning of concluding partial annularity	= T3 — 10 (11/15)	= T3 — 7.3	= T2 + 1.7 sec.
End of same	= T3 + 10 (17.5/16)	= T3 + 10.9	= T2 + 19.9 sec.

Duration of broken annularity = 4.5 sec.



1984 MAY 30

for Eastern U.S. (1)
and Mexico (2)

by David Herald

South Limit
Point (1″8 = 3·5km)
T3 — 10 secs.
P.A. 0°
30°
60°
90°
120°
3rd CONTACT = T3
T3 + 10 secs.
(3″2 = 6·1 km)
300°
T2 + 10 secs
2nd CONTACT = T2
T2 — 10 secs.
210°
P.A. 180°
2″2 = 4·2 km
North Limit
Point (2″6 = 5·0km)
1
2

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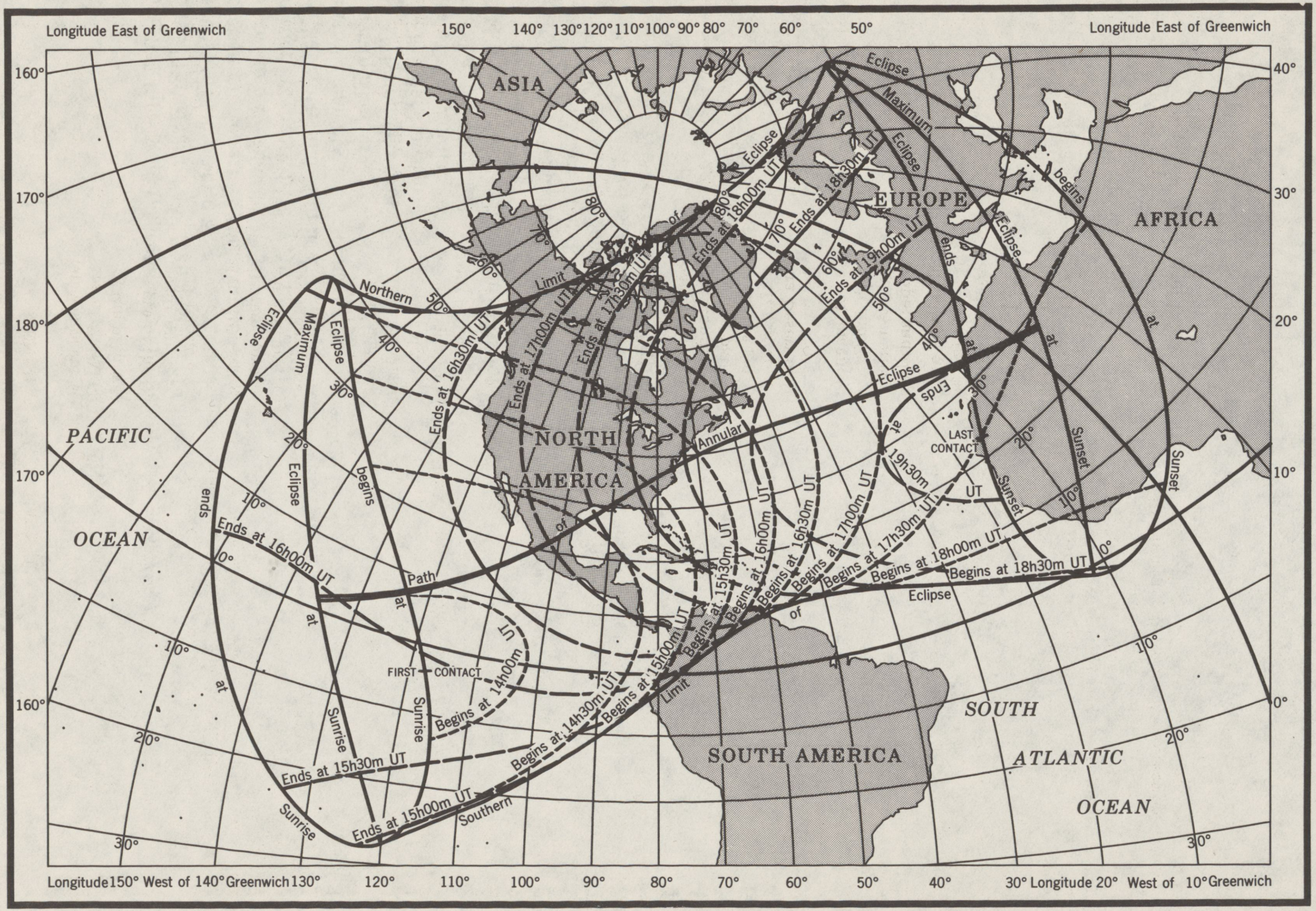
ANNULAR SOLAR ECLIPSE OF 1984 MAY 30


Longitude East of Greenwich
150° 140° 130° 120° 110° 100° 90° 80° 70° 60° 50°
Longitude East of Greenwich
160° 170° 180° 170° 160°
40° 30° 20° 10° 0°
ASIA
EUROPE
AFRICA
NORTH AMERICA
SOUTH AMERICA
PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
Northern Limit of Annular Eclipse
Path of Annular Eclipse
Southern Limit
Eclipse begins at Sunrise
Maximum Eclipse at Sunrise
Eclipse ends at Sunrise
Eclipse begins at Sunset
Maximum Eclipse at Sunset
Eclipse ends at Sunset
FIRST CONTACT Begins at 14h00m UT
LAST CONTACT Ends at 19h30m UT
Begins at 14h30m UT
Begins at 15h00m UT
Begins at 15h30m UT
Begins at 16h00m UT
Begins at 16h30m UT
Begins at 17h00m UT
Begins at 17h30m UT
Begins at 18h00m UT
Begins at 18h30m UT
Ends at 15h00m UT
Ends at 15h30m UT
Ends at 16h00m UT
Ends at 16h30m UT
Ends at 17h00m UT
Ends at 17h30m UT
Ends at 18h00m UT
Ends at 18h30m UT
Ends at 19h00m UT
80° 70° 60° 50° 40° 30° 20° 10° 0° 10° 20° 30°
Longitude 150° West of 140° Greenwich 130° 120° 110° 100° 90° 80° 70° 60° 50° 40° 30° Longitude 20° West of 10° Greenwich

GENERAL INFORMATION

An annular eclipse of the Sun will occur on Wednesday, 30 May 1984. It will be preceded and followed by associated penumbral eclipses of the Moon on 15 May and 13 June. The duration of annularity will be short, but the central portions of the path will lie across a heavily populated land area.

The last preceding annular eclipse of the Sun was on 4 December 1983 across central Africa. The next annular eclipse of the Sun will occur on 23 September 1987, when the path will lie across Asia and the South Pacific Ocean. However, annular-total eclipses are predicted to occur on 3 October 1986 and 29 March 1987; the former in the Arctic regions, the latter over the Atlantic Ocean and Africa. The last preceding eclipse in the same saros as this May 1984 eclipse was the 20 May 1966 eclipse, which was so close to totality at mid-point that Baily's Beads were observed completely around the Moon's limb. The next following eclipse in the same saros will be annular, on 10 June 2002, across the Pacific Ocean. The next total eclipse of the Sun will occur on 22-23 November 1984, when the path will cross eastern Indonesia and Papua New Guinea. A separate Circular will be issued.

Although the eclipse of 30 May 1984 was predicted by Oppolzer to be annular-total, modern ephemerides now give the prediction that it will be strictly annular up through any convenient flying altitude. However, the relative sizes of the disks are such that when the irregularities of the lunar limb are taken into account, complete annularity will probably not occur along the portion of the path in the United States. At the same time, it is not expected that Beads will be visible completely around the limb, as happened at the annular eclipse of May 1966, nor is it expected that the corona will be visible.

PATH AND VISIBILITY. The portion of the path over land will lie mostly in North America. At approximately 13h 54m U.T. on 30 May 1984, the center of the umbra of the Moon's shadow will first touch the Earth at sunrise in the Pacific Ocean, beginning the path of annular phase. The path will be approximately 69 km wide, and duration will be approximately 62 seconds. Proceeding northeastward across the Pacific Ocean, first landfall will occur approximately 90 minutes later, in Mexico. By then maximum duration at the center line will be about 32 seconds. The path will sweep across Mexico in 20 minutes, from 15h 25m U.T. to 15h 45m U.T., and then across the Gulf of Mexico in 20 more, to reach the United States at approximately 16h 05m U.T. The path will run from near New Orleans to Assateague Island, south of Ocean City, Maryland. The width will diminish from 10 km to 4 km, and duration of annularity on the center line from 14 seconds to less than 7. As seen from the central line, the width of the annulus will decrease from approximately 2.4 to 1.1 arc seconds. Along the way, the shadow will pass over or near many metropolitan areas. The narrowest part of the path will lie over the Atlantic Ocean just off the U. S. coast. Continuing over the north Atlantic Ocean, the path will graze over the northern Azores for 5 minutes, 18h 10m to 18h 15m U.T., then reach the African coast between Casablanca and Marrakesh at approximately 18h 30m U.T. and vanish into the Sahara Desert of Algeria. The umbra will leave the surface of the Earth at sunset at approximately 19h 35m U.T.

Partial phases of the eclipse, of magnitude decreasing with the distance from the path of annular phase, will be visible over all of North and Central America except Alaska; the central eastern Pacific Ocean; the northwest coast regions of South America; the Caribbean Sea and Gulf of Mexico; the north Atlantic Ocean; Greenland and Iceland; Europe; and the western part of northern Africa.

CHANGE IN CONTENTS. The type of information presented in these Circulars has been changing in the last few years, in an effort to satisfy the needs of more observers. The path at medium and high altitudes as a function of time has been discontinued. For those who wish to chart the path on their own maps, or perhaps observe from the air, the path is given as a function of longitude in two tables, with an associated correction table. The first table contains complete information on the coordinates of points on the center line and limits, the times when maximum eclipse will be reached at each, with altitude and azimuth of the Sun, and the duration of annularity and the width of the path. This information is tabulated at a half degree interval of longitude over land, except in the United States, where it is given at an interval of 7.5 minutes for those using maps of that series. The correction table gives the amount to be applied to latitude and time per 1,000 feet of altitude. This correction should be used for height above sea level by those who are planning precise observations. (This correction does not include the limb profile correction.) Another table gives the path as a function of longitude at flying altitudes. There is no correction necessary to the duration, path width, altitude and azimuth of the Sun, for elevations up to 50,000 feet.

The convention of longitude positive east has been newly adopted. There are also changes in ephemeris parameters, described below.

There is no graph for limb timing corrections because of the marginal situation described elsewhere.

There is a request for participation in an observing experiment.

The detail maps of the path are reproduced at their full scale because the path is so narrow.

PARAMETERS. The predictions in this Circular are derived from the solar and lunar data contained in an ephemeris developed jointly by the Jet Propulsion Laboratory and the U. S. Naval Observatory for use in the *Astronomical Almanac for 1984* and after. Resuming a practice discontinued in 1980, a correction has been applied to the lunar latitude to help account for the difference between center of figure and center of motion. It is −0.25 seconds of arc. Beginning with this eclipse the value of $k=0.2725076$ for the ratio of the radius of the lunar profile to the Earth's radius is used throughout the calculations. This was determined from occultation studies to be the best value representing the observed mean radius of Watt's datum, upon which the application of Watt's limb charts is based. The IAU adopted the new value for k in August 1982. As usual, all time arguments are in Universal Time (U.T.), using the best correction available at the time of preparation, and listed in the Elements of the Eclipse.

DEFINITIONS OF TERMS.

First and *fourth contacts* are, respectively, the beginning and the end of the partial phase. *Second* and *third contacts* are, respectively, the beginning and the end of the annular phase, if it occurs at the location given. *Duration* is the time interval between second and third contacts. Dot leaders indicate that a phenomenon occurs below the horizon for the given location.

The *position angle* of a point of contact on the solar limb is measured eastward (counterclockwise) around the solar limb. P is the position angle measured from the north point of the limb; V is the position angle measured from the vertex point. The north point lies on the great circle arc drawn from the north celestial pole to the center of the solar disk; the vertex lies on the great circle arc drawn from the zenith to the center of the solar disk. If the angle is listed as negative, you may add 360 degrees.

The *azimuth* of the Sun is measured along the horizon clockwise from the north point eastward to the foot of the great circle arc drawn from the zenith through the center of the solar disk down to the horizon. If it is listed as negative, either add 360 or measure westward from north.

The *magnitude* of the eclipse is the fraction of the apparent diameter of the solar disk covered by the Moon at the time of greatest phase, expressed in units of the solar diameter.

Degree of *obscuration*, prepared especially for this Circular, is the fraction (per cent) of the area of the apparent solar disk obscured by the Moon at maximum eclipse.

Inexperienced observers are cautioned to observe only by use of projected images, and not to use any method which would cause them to look directly toward the Sun.

LOCAL CIRCUMSTANCES. A table of accurate local circumstances for a list of geographic locations is provided. They are tabulated by state in the United States; then also under Mexico, Canada, and Other Countries. They were selected for location near the path, general geographic distribution, and size of population. Coordinates in the United States were taken directly from a computer file; outside the United States most were taken from *Goode's World Atlas, 14th Edition*; and a few, particularly in the Azores, were read from the detail maps in this Circular. All coordinates are approximate and assumed to be sea level. The printed circumstances correspond to the printed coordinates, in case there should be an error in identification or coordinates. It is often difficult in preparing maps and local circumstances to ascertain the correct name and spelling for a given location. Therefore, the information presented here is for location purposes only, is not authoritative, and does not imply official recognition of the status of any area by the United States government.

For the user who wishes to calculate his own local circumstances, the elements of conjunction, general circumstances, and Besselian Elements for Universal Time arguments are presented. The Besselian Elements are given as usual in tabular form, and also in polynomial form, courtesy of Dr. L. E. Doggett. Precepts for the calculations of local circumstances may be found in the Explanation of any recent *Astronomical Almanac*.

ESTIMATING LOCAL CIRCUMSTANCES

CONTACT TIMES. Beginning and end of the partial phase, or first and last contacts, can be estimated using the one-page overall map reproduced from the *Astronomical Almanac*. The dashed lines show the surface outline of the Moon's penumbra at a time interval of 30 minutes. The short dashes show the leading edge, the long dashes show the trailing edge. First contact occurs when the leading edge passes over the location in question, last contact occurs when the trailing edge passes. Duration is the time difference between contacts. The time halfway between is the middle of the eclipse. This is near the time of maximum eclipse, but not necessarily identical. At a given location, one need only estimate the intermediate position of the penumbra's edge between the starting and ending lines on either side and thus the time of the contact. For observers within the elongated teardrop curves to the extreme east and west, part of the eclipse occurs below the horizon.

Low precision times of second and third contacts in the central path can also be estimated. The central path over land is shown on a series of detail maps in the last part of this Circular. A few pages before the maps is a table of Local Circumstances for Points on the Central Line. On the maps, the heavy solid lines mark the northern and southern limits of the predicted path. Each dashed line represents the projection of the diameter of the umbra, joining the northern and southern limits and central point for the indicated instant—at which all points on the dashed line observe maximum eclipse.

The path is so narrow that estimates will be difficult, but use the maps and the table as follows: Find on the maps the location in the path for which you want local circumstances. From the one-minute cross lines on either side, estimate or measure the time t_0 when the projected axis line of the umbra will pass over the point. Turn to the Table of Local Circumstances for Points on the Central Line. Find where the time t_0 fits into the first column on each page. Using the appropriate fraction of the time interval, read across both pages and interpolate the times of second and third contacts, the duration (D), and width of path. Make a note of the angles P and V for each contact, and also the altitude (a) and azimuth (A) of the Sun at maximum eclipse. Turn back to the map. If you mark the cross lines for the second and third contact times, you can see the breadth of the projected shadow. Now draw a line through the observing point perpendicular to the path. Estimate or measure how far the point is from the center of the path and call this quantity a. Set b equal to half the width of the path. Next compute the approximate duration (T) for the selected location by $T = D\sqrt{(1 - (b/a)^2)}$. Then the time of second contact is approximately $t_0 - T/2$, third contact $t_0 + T/2$.

POSITION ANGLES. The appropriate profile for this eclipse is reproduced from Circular No. 141. For locations in the central path, the predicted times and position angles of contacts are based on the Moon's mean limb (the dashed circle). Correction for limb irregularities is discussed later. In working with this construction, remember that position angles are given for the solar disk, which is observable, but corrections are based on features on the lunar disk, shown in the diagram. The two nearly coincide between second and third contacts, so it is adequate to plot angles pertaining to the Sun on the lunar diagram. However, this is not the case for first and fourth contacts. You may find it convenient to use a transparent overlay with a circle of radius three inches.

For each second or third contact to be sketched, take from the tables the time of contact (t_c), the angles P and V, and the altitude (a) and azimuth (A) of the Sun at maximum eclipse, as described above. Convert the time of contact to hours and decimals. Compute the angle C from the following equation, in which all numerical quantities are degrees:

$$C = 349.45 + 0.207t_c - 0.407 \sin(90 - a) \sin (P - V).$$

On the diagram, N marks lunar north. Using the four direction tick marks, find the center of the circle. Draw a line from the center through N. Next measure the angle C westward (clockwise) from N. Mark the point on the mean limb and draw a line from the center through it. This points to the Earth's north celestial pole. From this line, measure back the angle P eastward (counterclockwise) to find the point of contact on the mean limb. Draw a line from the center out through that point. Finally, from that line, measure through the angle V westward (clockwise). Draw a line from the center through this point. This line points to the observer's zenith. Now you can visualize events as follows: Face in the direction of the Sun's azimuth (A), measured in degrees positively from the north point of the horizon around clockwise to the east, hold the diagram up at arm's length at the altitude (a) of the Sun at maximum eclipse, and turn it so that the line pointing to the zenith points straight up. The line to the north point of the disk will point to celestial north for the observing site, and the point of contact at the limb will be at its correct apparent orientation.

To get position angles for locations not listed in the tables, follow the directions above and plot the points of second and third contacts for the interpolated location *on the center line.* Draw a line connecting the two contacts on the mean limb. It should pass through the center of the disk. Next, draw or construct a perpendicular diameter, which runs approximately north/south. Taking (b/a) from the calculation of duration, measure off (b/a) × radius from the center of the circle along the north/south diameter in the opposite direction as the observing site. Mark the point on the diameter, and draw or construct a perpendicular line parallel to the one through the central line contact points. This new line will intersect the mean limb at approximately the points of contact. The western point is for second contact, the eastern is for third contact. This construction is not as accurate as a full calculation, but adequate for field estimates.

LIMB CORRECTIONS. The predictions of limits and contact times in this Circular refer to the mean limb, and the beginning and end of a complete ring of light. For true annularity, the solar crescent must form into an annulus which simultaneously clears all mountain peaks around the limb. Using the precepts set forth by Mr. David Herald, as described in Circular No. 165, it is normally quite easy to use the Lunar Limb Profile to take into account the limb effects on predicted contact times. However, for this eclipse the magnitude will be so nearly unity during the passage through the United States that there will exist for the most part what Herald terms "partial annularity," in that as seen from within the path, the annulus will always be broken in at least one point by a mountain peak at the lunar limb. Thus true second and third contacts never occur for the observer. Toward the edges of the path the effect will be one of a continuous string of Baily's Beads stretched between the cusps of the crescent. In the narrow zones right at the predicted limits the number of Beads present will be a sensitive indicator of the location of the observer relative to the shadow axis.

If one draws two circles of slightly different radius, tangent internally, it is quite easy to derive a good approximation for h, the radial separation of the limbs as a function of position angle. Using units of arc seconds, let h be the separation, R be the lunar radius, M the magnitude, and P the angle from the point of contact. Then $h = R\,(M-1)\,(1-\cos P)$. Over the United States portion of the path, M will lie in the range 0.9974—0.9988, and R can be taken from the Elements. However, from a topocentric location the apparent size of the Moon will be augmented such that the apparent radius of the Sun will be greater by only 2.4—1.1 seconds of arc. To see the effects of this range, on the Lunar Limb Profile, using the scale bar at the top, draw circles 1 and 2 seconds of arc larger than the dashed circle. From the center line, the rough southern limb will cause several continuing breaks, and the Beads will be numerous to the north side of the path. To find the local effects, use the expression for h above coupled with the radial scale for the lunar limb to generate the relative solar profile. This can be applied at the contact points found from local circumstances. In shifting the curve to estimate limb effects, be sure to shift parallel to the line joining the contact points.

ACKNOWLEDGEMENTS. Marie Lukac prepared the overall line map and the detail maps of the path over land. The latter is presented on portions of Operational Navigation Charts (ONC) J-24, H-23, H-24, G-20, G-21, G-24, G-1, H-2, scale 1:1,000,000, Lambert Conformal Conic Projection. These maps are a product of Defense Mapping Agency Aerospace Center. The portions in this Circular are at original size.

The Lunar Limb Profile chart is from *U. S. Naval Observatory Circular No. 141*, "Lunar Limb Profiles for Solar Eclipses," by Julena S. Duncombe, March 16, 1973.

The polynomial representation of the Besselian Elements was programmed by Dr. Leroy Doggett, Nautical Almanac Office.

Climatological data was contributed by a meteorologist, Jay Anderson, of Winnipeg, Manitoba. Additional comments were contributed by Joseph Rao, of New York City.

Some of the composition typing was done by Marion Sosslau, Nautical Almanac Office.

OBSERVATIONS. Precise timing observations are requested, as described elsewhere. Information on photography, direct viewing, and projection methods may be found in the following publications:

"Safe Solar Filters," by B. Ralph Chou, *Sky and Telescope*, August 1981, p. 119.
"Observing the Sun in Safety," by J. C. D. Marsh, *J. Brit. astron. Assoc.*, 1982, 92, 6, p. 237.
Astrophotography Basics, Kodak Customer Service Pamphlet AC—48, 1981.
A Complete Manual of Amateur Astronomy, by P. Clay Sherrod, Prentice Hall, 1981.
Eclipse, by Bryan Brewer, 1979.
Observe: Eclipses, by R. Sweetsir and M. Reynolds, Astronomical League, 1979.

FURTHER INFORMATION. Inquiries concerning special calculation of local circumstances and extensions or modifications of data in this publication should be directed to the Nautical Almanac Office.

OBSERVING AT THE EDGE OF THE PATH

There is a kind of observation in which anyone can participate and which would be useful in an established research investigation; that is, the exact determination of the edges of the shadow path upon the surface of the earth. This is important in helping determine whether the Sun's photosphere, or light-emitting disk, has a significant variation in size over a time of many years.

The ideal thing would be to have thousands of individuals stationed about one hundred feet apart throughout two strips of country, covering the two edges of the calculated shadow path. If each of these thousands of observers (human sensors) reported his or her exact position on the earth's surface and the duration of annularity, if any, at that position, the data obtained would permit the calculation of the eclipse path with unprecedented accuracy.

So comprehensive a plan of observation as this is impracticable, but a great deal of valuable data can be obtained if persons near the calculated edge of the path during the eclipse note down and report these few facts: one, the location to the nearest foot with respect to points identifiable on a survey map; two, whether the eclipse was completely annular at that point; and three, if so, the duration to a fraction of a second.

It is advisable to work in teams of two or more, so that one person is the observer and the second is the recorder and general manager. Events will happen very rapidly. The sequence of observing events must be worked out in advance and rehearsed.

As second contact and annularity approach, the observing team should start a tape recorder, if they have one, and record time pips of some sort. The method of observing the Sun is left up to the observer, but it should be safe to the eyes and comfortable to the back and neck. Do not tire your eyes looking too long or too often at the relatively uninteresting partial phases of the eclipse. Do not look directly at the Sun at all unless you have some kind of special metallic-coated filter for the purpose. Projection methods are preferred and safe. The observer should concentrate on watching the crescent and having a stopwatch ready. The recorder should watch the time on a clock, keep the tape running, keep the area clear, and make notes as necessary.

The observer will see the trailing cusps of the crescent grow toward surrounding the Moon, then begin to "spark" into Baily's Beads across the remaining gap, beginning several minutes before predicted contact. As many events of formation and disappearance as possible may be recorded as the beads form and merge. The designated observer and recorder should not attempt photography during these events because complete concentration is required, and still photographs are not scientifically useful. (It would probably be useful, however, if another person could make a timed videotape or movie of a projected image.) The merging of the cusps into the annulus is second contact, and the stopwatch should be started and a note made as to whether it is running and the estimated reaction time. The observer should keep watching for third contact, or the first break in the annulus. At that instant the stopwatch should be stopped. As beads form and disappear with the emerging crescent, as many events as possible may be recorded. Final time pips should be made for the tape before shutting down, and the duration of annularity from the stopwatch recorded. It is important to know if annularity did *not* occur, as is most likely for this eclipse, because that is a very sensitive indicator of the path limits.

The team should add final notes on the sky conditions, unusual occurrences or problems; estimates of reliability of timings or observer's reaction time; etc. and a note of the position of the station using the coupon elsewhere in this Circular.

SAMPLE—See also inside back cover

ECLIPSE REPORT COUPON

If you observe near the eclipse track on May 30, as described elsewhere in this Circular, the report of your observations may be sent in on this coupon. Answer as many questions as you can. Send your report to:

Eclipse Observations,
U. S. Naval Observatory, NAO,
Washington, DC 20390.

1. If the sun is not quite eclipsed at your station there will always be a break in the annulus, or ring, which may appear as just a single small dark point. One break may appear at the leading edge of the moon before the ring has formed at the trailing edge. At your station was there any time at which the entire ring around the moon was visible with no breaks? Answer YES or NO.

2. If the complete bright ring of the sun around the moon formed, how many seconds elapsed before it was broken again?
Answer: Seconds.

3. Was the time given in the last question guessed or measured?
If measured, describe how. Give Standard or Universal Times, if used.

4. Describe and give timings on any bead events.

5. What were sky conditions, and did you observe any other unusual phenomena associated with the eclipse?

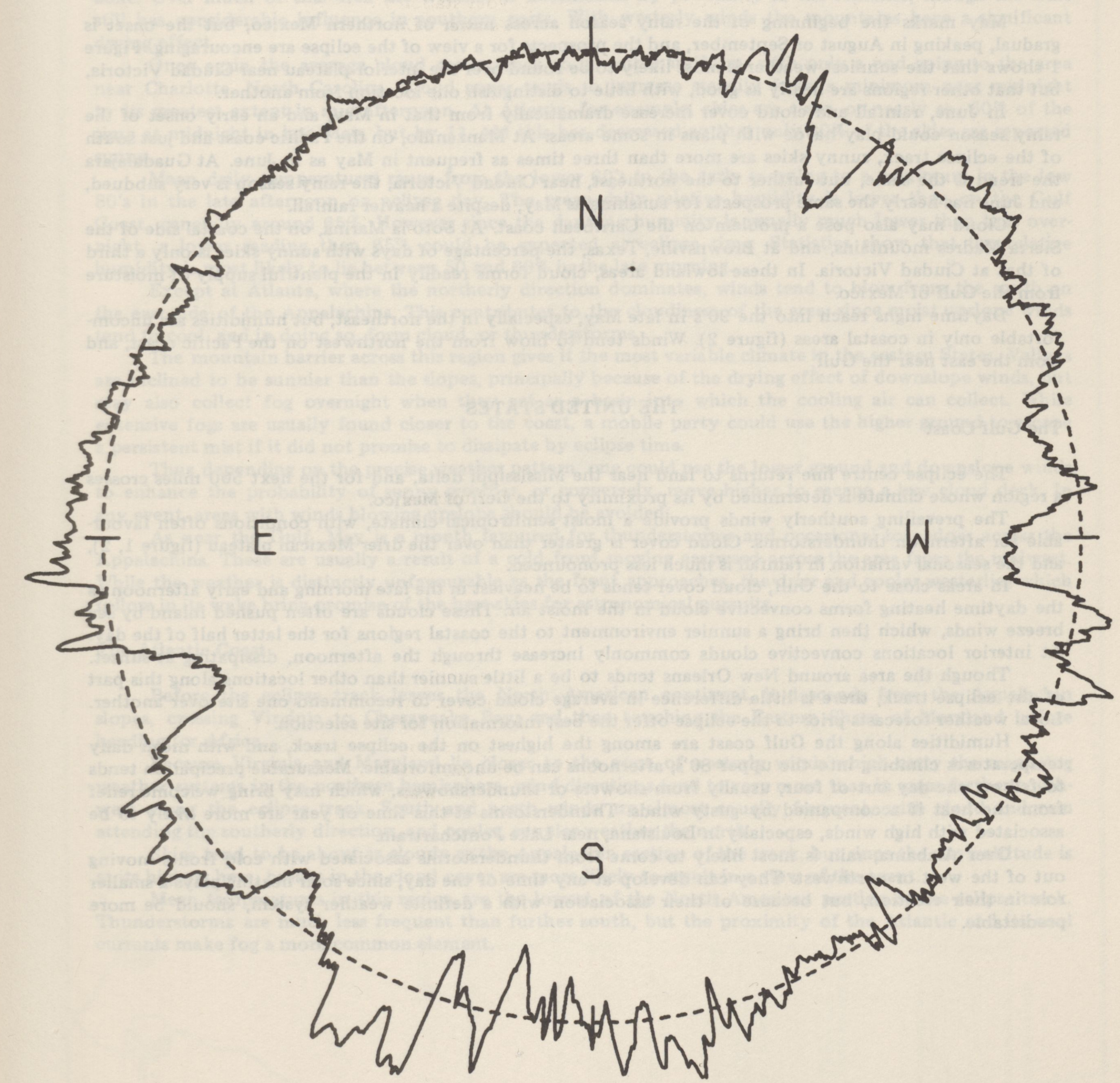
6. It is necessary to know your position very accurately, so that the astronomers compiling the observations know just where to place your observations on a map. Accordingly, give your position by the nearest street or road intersection, measured in feet from the intersection and from the center of the road, or by means of some easily located building or other landmark which can be placed easily on a map by a person familiar with the area. If you have a map of the area, such as provided by a Chamber of Commerce or a survey, mark your position on the map and include it with your report. Otherwise, please include a sketch.

7. Please give your name, address, and (optional) telephone number.

LUNAR LIMB PROFILE
L=-5°.00 B=0°.00

RADIAL SCALE: 1 SECOND OF ARC = |—|

DOTTED LINE = MEAN LIMB SOLID LINE = TRUE LIMB



For this eclipse, which will be of interest to so many people, we are fortunate to have weather studies by two professional meteorologists. First, at our invitation, Mr. Jay Anderson returns with a complete meteorological study incorporating statistics and satellite information.

WEATHER PROSPECTS FOR THE ECLIPSE

by Jay Anderson
6 Dunelm Lane, Winnipeg, MB, Canada R3R 0R1

May is a time of change across North America and the annular eclipse samples a variety of climatic zones as it races across Mexico, crosses into the Gulf States, and tracks northeastward to the Atlantic before ending its visit over the deserts of Algeria. The climatological record shows that the weather prospects are mixed: best in Mexico and Africa, and cloudier across the United States.

MEXICO

May marks the beginning of the rainy season across much of northern Mexico, but the onset is gradual, peaking in August or September, and the prospects for a view of the eclipse are encouraging. Figure 1 shows that the sunniest weather is most likely to be found over the interior plateau near Ciudad Victoria, but that other regions are nearly as good, with little to distinguish one location from another.

In June, rainfall and cloud cover increase dramatically from that in May, and an early onset of the rainy season could play havoc with plans in some areas. At Manzanillo, on the Pacific coast and just south of the eclipse track, sunny skies are more than three times as frequent in May as in June. At Guadalajara the trend is the same, but further to the northeast, near Ciudad Victoria, the rainy season is very subdued, and June has nearly the same prospects for sunshine as May, despite a heavier rainfall.

Cloud may also pose a problem on the Carribean coast. At Soto la Marina, on the coastal side of the Sierra Madres mountains, and at Brownsville, Texas, the percentage of days with sunny skies is only a third of that at Ciudad Victoria. In these lowland areas, cloud forms readily in the plentiful supply of moisture from the Gulf of Mexico.

Daytime highs reach into the 90's in late May, especially in the northeast, but humidities are uncomfortable only in coastal areas (figure 2). Winds tend to blow from the northwest on the Pacific coast, and from the east near the Gulf.

THE UNITED STATES

The Gulf Coast

The eclipse centre line returns to land near the Mississippi delta, and for the next 500 miles crosses a region whose climate is determined by its proximity to the Gulf of Mexico.

The prevailing southerly winds provide a moist semitropical climate, with conditions often favourable for afternoon thunderstorms. Cloud cover is greater than over the drier Mexican plateau (figure 1, 2), and the seasonal variation in rainfall is much less pronounced.

In areas close to the Gulf, cloud cover tends to be heaviest in the late morning and early afternoon as the daytime heating forms convective cloud in the moist air. These clouds are often pushed inland by sea breeze winds, which then bring a sunnier environment to the coastal regions for the latter half of the day. At interior locations convective clouds commonly increase through the afternoon, dissipating at sunset.

Though the area around New Orleans tends to be a little sunnier than other locations along this part of the eclipse track, there is little difference in average cloud cover to recommend one site over another. Local weather forecasts prior to the eclipse offer the best information for site selection.

Humidities along the Gulf coast are among the highest on the eclipse track, and with mean daily temperatures climbing into the upper 80's, afternoons can be uncomfortable. Measurable precipation tends to fall on one day out of four, usually from showers or thundershowers, which may bring welcome relief from the heat if accompanied by gusty winds. Thunderstorms at this time of year are more likely to be associated with high winds, especially in Louisiana, near Lake Pontchartrain.

Over Alabama, rain is most likely to come from thunderstorms associated with cold fronts moving out of the west or northwest. They can develop at any time of the day, since solar heating plays a smaller role in their creation, but because of their association with a definite weather system, should be more predictable.

Drier weather comes to the Gulf states whenever winds turn to the west or northwest and bring continental air into the region. In Louisiana winds blow out of the northwest quadrant about 15% of the time (table 1) but further along the track, this has increased to 25%, with a corresponding reduction in the frequency of southerly winds.

Tornadoes are a relatively rare event, but May is one of the more favoured months for them across Louisiana, Mississippi, and Alabama. Luckily they affect only small areas and can be avoided. Tropical storms do not begin crossing this region before June.

The Appalachins

As the eclipse line crosses the south end of the Appalachin Mountains in Alabama, and then runs along its eastern slopes through Georgia and the Carolinas, it moves into a cooler and less humid climatic zone. Over much of this area the weather is determined by proximity to the Atlantic, though the Gulf still has considerable influence in southern parts. With westerly winds the mountains have a significant drying effect.

Once again the average cloud cover tends to be rather uniform, with only a nod going to the area near Charlotte, North Carolina. Cloud cover tends to increase steadily from a minimum near midnight to its greatest extent in mid afternoon. At Atlanta, for example, skies are clear, or nearly so, 60% of the time at midnight in late May, but by 11 AM this has decreased so that only 30% of the skies are reported sunny.

Mean daily temperatures range from the lower 60's in the early morning to a maximum in the low 80's in the late afternoon on eclipse day. The mean daily relative humidity is lower than on the Gulf Coast, generally around 65%. However since the daytime humidity is usually much lower than that overnight, a lower reading than 65% could be expected at eclipse time. Statistics show that the relative humidity is most likely to lie between 50 and 69% in the late morning.

Except at Atlanta, where the northerly direction dominates, winds tend to blow from the south on the east side of the Appalachins. This contributes to the cloudiness of the area, since moist upslope winds tend to cool, and in doing so, form cloud, or thunderstorms.

The mountain barrier across this region gives it the most variable climate in the eastern States. Valleys are inclined to be sunnier than the slopes, principally because of the drying effect of downslope winds, but may also collect fog overnight when they act as a basin into which the cooling air can collect. While extensive fogs are usually found closer to the coast, a mobile party could use the higher ground to escape a persistent mist if it did not promise to dissipate by eclipse time.

Thus depending on the precise weather pattern, one could use the lower ground and downslope winds to enhance the probability of sunny weather, or conversely, move higher to escape a low cloud deck. In any event, areas with winds blowing upslope should be avoided.

As near the Gulf, May is a month favoured for thunderstorms and occasional tornadoes across the Appalachins. These are usually a result of a cold front moving eastward across the area from the midwest. While the weather is distinctly unfavourable as the front approaches, the drier and cooler westerlies which follow in its wake bring promise of the best skies for astronomical pursuits.

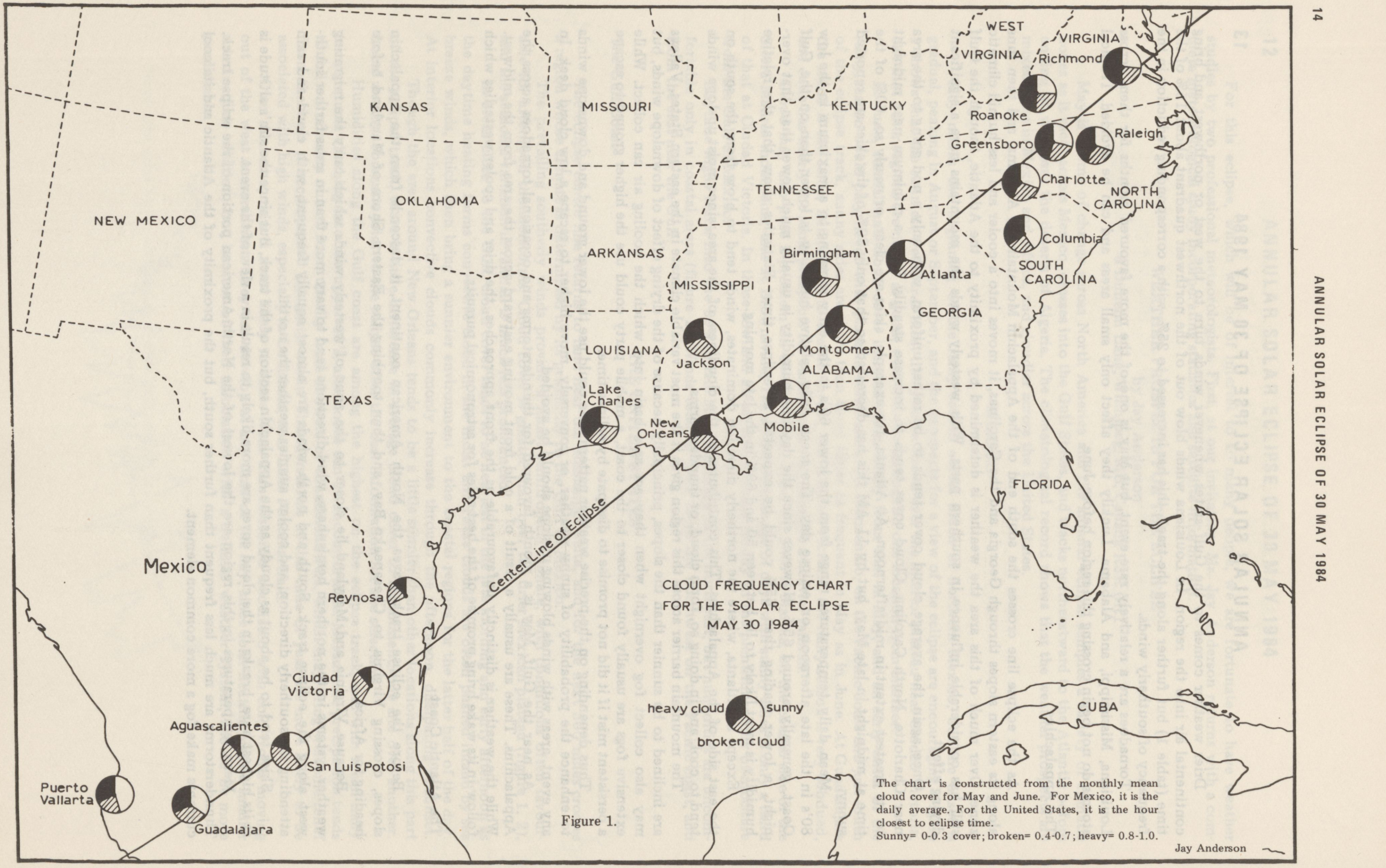
The Atlantic Coast

Before the eclipse track leaves the North American continent, it descends from the Appalachin slopes, crossing Virginia to Chesapeake Bay, and then touching the Eastern Shore of Maryland before heading for Africa.

Because Virginia and Maryland lie closer to the zone of westerly winds which carry the migrating weather systems in the northern hemisphere, wind directions tend to vary more than in areas farther southwest along the eclipse track. South and north winds are almost equally frequent, with cloud and rain attending the southerly direction, and cooler, sunnier weather the north.

Skies tend to be about as cloudy as the Appalachin section of the track, but since the sun's altitude is at its highest here, breaks in the cloud cover are more likely to result in a view of the event.

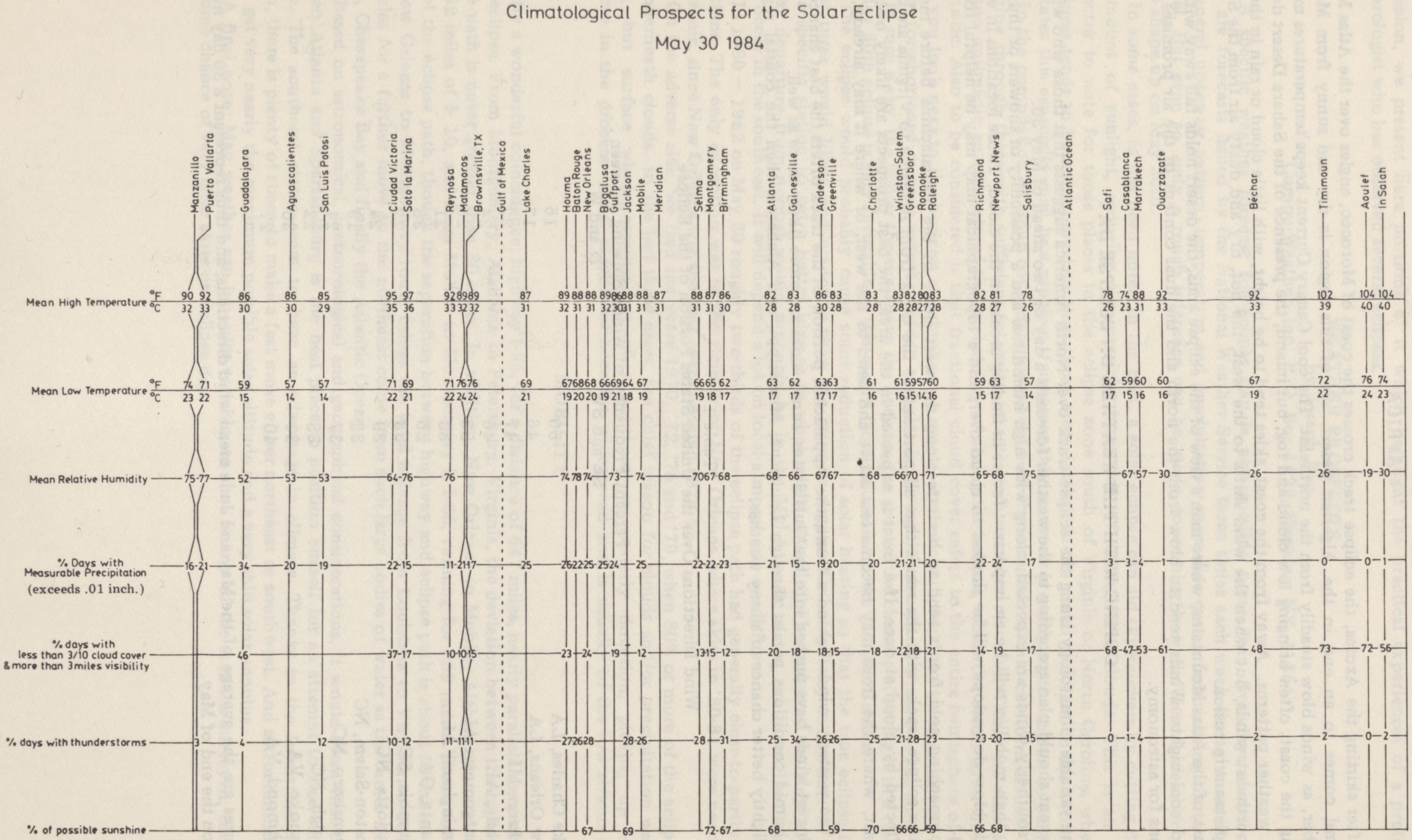
Mean temperatures in this region are the lowest of the North American portion of the eclipse track. Thunderstorms are much less frequent than further south, but the proximity of the Atlantic and its cool currents make fog a more common element.


CLOUD FREQUENCY CHART
FOR THE SOLAR ECLIPSE
MAY 30 1984
heavy cloud
sunny
broken cloud
Center Line of Eclipse
NEW MEXICO
KANSAS
MISSOURI
KENTUCKY
WEST VIRGINIA
VIRGINIA
OKLAHOMA
TENNESSEE
NORTH CAROLINA
ARKANSAS
SOUTH CAROLINA
MISSISSIPPI
GEORGIA
LOUISIANA
ALABAMA
TEXAS
FLORIDA
Mexico
CUBA
Richmond
Roanoke
Raleigh
Greensboro
Charlotte
Columbia
Atlanta
Birmingham
Montgomery
Jackson
Mobile
New Orleans
Lake Charles
Reynosa
Ciudad Victoria
Aguascalientes
San Luis Potosi
Puerto Vallarta
Guadalajara

The chart is constructed from the monthly mean cloud cover for May and June. For Mexico, it is the daily average. For the United States, it is the hour closest to eclipse time.
Sunny= 0-0.3 cover; broken= 0.4-0.7; heavy= 0.8-1.0.

Figure 1.

Jay Anderson


Climatological Prospects for the Solar Eclipse
May 30 1984

Jay Anderson

Figure 2. Average of May and June Monthly Means for Weather Data. Exception: Temperature mean is for May 30 in USA

AFRICA

After skirting the Azores, the eclipse track crosses the coast of Morocco, angles over the Atlas Mountains, and comes to an end in the Algerian desert. All of this region is dry and sunny from May to September, as winds blow steadily from the northeast. The cool Canary Current keeps temperatures moderate along the coast, often bringing low cloud and fog, but inland, the presence of the Sahara Desert dominates the weather patterns. Away from the coast, skies tend to be bright, with little cloud or rain in the persistent northeast winds, but when the wind shifts to the west, the hot, dry and dusty air from the Sahara is an unpleasant intrusion.

East of the Atlas Mountains, where man's view of the eclipse ends, the desert holds full sway with hot days and cool nights. Winds tend to blow from the north and the dust content of the air promises poor conditions for astronomy.

COPING WITH THE WEATHER ON ECLIPSE DAY

The variable climatology along the eclipse track over North America suggests that those who wish to see this event should plan according to the weather forecasts a day or two ahead of May 30.

If southerly winds are expected, along with high humidities and a possibility of showers or thundershowers, then mobility will be an important factor in finding breaks in the cloud. Those locations in which the winds blow downslope will be slowest to cloud over, and a topographical map may be helpful for site selection.

Approaching cold fronts tend to hesitate along the west slope of the Appalachins before moving toward the eclipse track, with the result that all portions of the track from Alabama to Virginia are likely to be affected by cloud at once. If a front is expected in the area, the best prospects are likely over the Gulf Coast, where the front may become less active and bend to the west, or where it may already have passed.

In the westerly winds behind a front, the Appalachin portion of the track offers the best chances. If the northwest winds have pushed into the Gulf States, sunny skies are more likely there as well.

If humid conditions persist through Louisiana, Mississippi, and Alabama, then the coastal regions offer a slightly better chance of sunny weather.

Table 1
Wind Directions Over the United States Portion of the Eclipse

	Percent Frequency of Winds Blowing Between . . .	
	SE and SW	N and W
Lake Charles, LA	50	15
New Orleans, LA	46	17
Jackson, MI	47	22
Mobile, AL	46	24
Montgomery, AL	35	26
Birmingham, AL	33	21
Atlanta, GA	25	38
Columbia, SC	33	22
Charlotte, NC	39	24
Winston-Salem, NC	32	19
Greensboro, NC	37	24
Raleigh, NC	38	22
Roanoke, VA	31	30
Richmond, VA	40	27

These figures are the average of the May and June mean wind directions, and thus represent a 30 day mean centered on the end of May.

Mr. Joseph Rao has compiled an extensive report on viewing prospects for this eclipse. With his kind permission, we present here portions of it which highlight the practical experiences of a professional meteorologist who has observed several eclipses.

WEATHER PROSPECTS

by Joseph Rao
Compu-Weather, Inc., P. O. Box 1122, Flushing, NY 11354

A specific weather forecast for eclipse day is not possible more than five days ahead of time. There are forecasts issued by the National Weather Service three times each week that give an idea as to the general upper-air pattern, temperature and precipitation anomalies over a forthcoming six to ten day interval. But even so, only a rough inference can be made concerning how the actual weather patterns would shape up on May 30th.

In some cases, as has been noted in the past, a solar eclipse can aid skywatchers by cutting down on the amount of sunlight, reducing the possible formation of cumuliform clouds. This is an important factor to note for those places in the eclipse zone south of Virginia or North Carolina, where such cloudiness tends to be more prevalant than those areas further to the north and east. In the humid southeast states this especially may be a problem if unseasonably warm air is overlying the region on eclipse day.

In the compilation of cloud cover data we should note the inclusion of thin cirriform clouds. The sun can shine through these with sufficient intensity to activate a sunshine recorder. Thus, the sunshine data gives too optimistic an estimate of the probability of seeing the eclipse, while the cloud cover data is too pessimistic. Also to be considered is that fractional cloud cover refers to the entire hemisphere of the sky. When you look near to the horizon at a broken or even scattered cloud deck, the intervening gaps of clear sky are foreshortened or may even be hidden completely, giving the cloudiness a more-or-less solid appearance. In such a sky, the higher the sun above the horizon, the greater the chances of seeing it in a clear spot. The May 30th eclipse is very favorable in this regard from Louisiana to the Maryland shore.

The eclipse would probably cause some reduction of solar heating so that the true eclipse induced temperatures would likely end up lower than the normals suggest. One might try to subtract 5^{o} to 15^{o} from a specific station to get a better idea as to what might actually be experienced on May 30th. The greatest departure from normal would probably be in the Mid-Atlantic states, while smaller departures might occur in the southeast. It will depend a lot on local atmospheric conditions.

In 1980 — 1982 on May 30 roughly two-thirds of the eclipse path had generally clear-to-partly cloudy conditions. The only exception was in the vicinity of New Orleans where skies in '80-81 were nearly overcast. Ironic, since New Orleans was the best overall during 1970-82.

On the adverse side, we find the years 1970, '72, '75 and '79, when 80% or more of the eclipse zone lay underneath clouds. In the last three cases, the chief reason for clouds and/or precipitation was not a storm, but surface winds coming out of a southeast or easterly direction, picking up Atlantic moisture in the process. Thus, cloudiness becomes widespread and is usually of the low stratus variety.

MOBILITY

By a wonderful coincidence, highway I-85, for a distance of 647 miles, nearly parallels the path of the 1984 eclipse. From Montgomery, Alabama to Petersburg, Virginia, the deviation between the highway and eclipse path is never greater than 30 miles. In addition, New Orleans to Mobile, Alabama is connected by the 132 miles of I- 10, and from Mobile to Montgomery is I-65, running for 169 miles. These routes also parallel the eclipse path, though the separation between highway and eclipse path is about 50 miles. Adding the New Orleans to Montgomery route brings the total mileage from Louisiana to Virginia to 957 miles. Obstacles for a further move to the northeast come from such large bodies of water as the James and York Rivers, Chesapeake Bay and finally the Atlantic Ocean.

Based on astronomical, meteorological and geographical considerations, it would seem that the area between Atlanta and Spartansburg is the best place to position oneself for an attempt to view the 1984 eclipse. The southeast states seem to have an advantage in climate. Thanks to the Interstate highway system, there is plenty of room to make a fast move either northeast or southwest. And astronomically, one would get very nearly the maximum possible solar altitude and a very thin solar annulus.

A final note: May weather can be quite variable, so that at any of the stations surveyed, there is at least some chance of very clear skies on eclipse day.

ELEMENTS OF THE ECLIPSE

U.T. of geocentric conjunction in right ascension, May $30^d 16^h 52^m 38^s.700$

Julian Day No. = 2445851.2032256920

	h m s		s
Right Ascension of Sun	4 31 03.479	Hourly Motion	10.216
Right Ascension of Moon	4 31 03.479	Hourly Motion	137.882
Δ T	+54.12		
	° ' "		' "
Declination of Sun	+21 52 08.30	Hourly Motion	+ 0 21.66
Declination of Moon	+22 08 16.44	Hourly Motion	+ 7 55.15
Equatorial hor. par. of Sun	8.67	True semidiameter of Sun	15 46.4
Equatorial hor. par. of Moon	56 54.25	True semidiameter of Moon	15 30.4

CIRCUMSTANCES OF THE ECLIPSE

	U. T. d h m	(- West) Longitude ° '	Latitude ° '
Eclipse begins	May 30 13 54.3	-117 39.1	- 3 52.6
Central eclipse begins	14 57.5	-135 36.1	+ 1 31.0
Central eclipse at local apparent noon	16 52.6	- 73 47.1	+38 35.7
Central eclipse ends	18 32.0	+ 3 43.7	+28 03.1
Eclipse ends	19 35.1	- 14 41.4	+22 45.9

BESSELIAN ELEMENTS, POLYNOMIAL FORM

The equations below represent a simple least-squares polynomial fit to the tabular Besselian Elements. Do not use T outside the given range, and do not omit any terms in the series.

Let T be the Universal Time in hours, such that $13^h917 \leq T \leq 19^h5$, i.e., $13^h55^m - 19^h30^m$

$$x = -8.74259272 + 0.51316100\,T + 0.00040385\,T^2 - 0.00000692\,T^3, \quad \text{Error} < 7\text{X}10^{-7}$$

$$y = -1.99466901 + 0.13646921\,T - 0.00005289\,T^2 - 0.00000192\,T^3, \quad \text{Error} < 5\text{X}10^{-7}$$

$$\sin d = 0.37089469 + 0.00009480\,T - 0.00000007\,T^2 \quad \text{Error} < 5\text{X}10^{-7}$$

$$\cos d = 0.92867517 - 0.00003793\,T + 0.00000003\,T^2 \quad \text{Error} < 5\text{X}10^{-7}$$

$$\mu = -179.37377312 + 14.99990097\,T - 0.00000146\,T^2 \quad \text{Error} < 5\text{X}10^{-7}$$

$$\text{Radius penumbra} = 0.55009917 + 0.00024230\,T - 0.00001073\,T^2 \quad \text{Error} < 5\text{X}10^{-7}$$

$$\text{Radius umbra} = 0.00371357 + 0.00023790\,T - 0.00001049\,T^2 \quad \text{Error} < 5\text{X}10^{-7}$$

BESSELIAN ELEMENTS

U.T.		Intersection of Axis of Shadow with Fundamental Plane		Direction of Axis of Shadow			Radius of Shadow on Fundamental Plane	
h	m	x	y	sin d	cos d	μ °	Penumbra	Umbra
13	40	-1.671630	-0.144365	+0.372177	0.928162	25.62461	0.551399	+0.004988
	50	1.584907	0.122044	.372193	.928156	28.12458	.551390	.004979
14	00	-1.498177	-0.099730	+0.372208	0.928149	30.62456	0.551380	+0.004970
	10	1.411440	0.077424	.372223	.928143	33.12454	.551370	.004959
	20	1.324698	0.055125	.372239	.928137	35.62451	.551359	.004949
	30	1.237950	0.032834	.372254	.928131	38.12449	.551347	.004937
	40	1.151196	-0.010550	.372270	.928125	40.62447	.551335	.004925
	50	1.064436	+0.011726	.372285	.928118	43.12444	.551322	.004912
15	00	-0.977671	+0.033995	+0.372301	0.928112	45.62442	0.551309	+0.004899
	10	0.890901	0.056255	.372316	.928106	48.12440	.551295	.004885
	20	0.804126	0.078508	.372332	.928100	50.62437	.551281	.004871
	30	0.717347	0.100753	.372347	.928094	53.12435	.551266	.004856
	40	0.630563	0.122991	.372362	.928087	55.62433	.551250	.004840
	50	0.543774	0.145220	.372378	.928081	58.12430	.551233	.004824
16	00	-0.456981	+0.167441	+0.372393	0.928075	60.62428	0.551217	+0.004807
	10	0.370185	0.189654	.372409	.928069	63.12425	.551199	.004789
	20	0.283384	0.211860	.372424	.928063	65.62423	.551181	.004771
	30	0.196580	0.234057	.372439	.928057	68.12421	.551162	.004753
	40	0.109773	0.256245	.372455	.928050	70.62418	.551143	.004733
	50	-0.022962	0.278426	.372470	.928044	73.12416	.551123	.004714
17	00	+0.063852	+0.300598	+0.372485	0.928038	75.62413	0.551102	+0.004693
	10	0.150668	0.322762	.372501	.928032	78.12411	.551081	.004672
	20	0.237488	0.344917	.372516	.928026	80.62408	.551059	.004650
	30	0.324309	0.367064	.372532	.928020	83.12406	.551037	.004628
	40	0.411133	0.389202	.372547	.928013	85.62404	.551014	.004605
	50	0.497959	0.411332	.372562	.928007	88.12401	.550990	.004582
18	00	+0.584787	+0.433453	+0.372578	0.928001	90.62399	0.550966	+0.004558
	10	0.671616	0.455566	.372593	.927995	93.12396	.550941	.004533
	20	0.758447	0.477669	.372608	.927989	95.62394	.550916	.004508
	30	0.845279	0.499764	.372624	.927983	98.12391	.550890	.004482
	40	0.932113	0.521850	.372639	.927976	100.62389	.550863	.004455
	50	1.018947	0.543927	.372654	.927970	103.12386	.550836	.004428
19	00	+1.105782	+0.565995	+0.372670	0.927964	105.62384	0.550808	+0.004400
	10	1.192617	0.588055	.372685	.927958	108.12381	.550779	.004372
	20	1.279453	0.610105	.372700	.927952	110.62378	.550750	.004343
	30	1.366289	0.632146	.372716	.927946	113.12376	.550721	.004314
	40	1.453125	0.654178	.372731	.927939	115.62373	.550690	.004284
19	50	+1.539960	+0.676200	+0.372746	0.927933	118.12371	0.550660	+0.004253

TAN F1 0.004612
TAN F2 0.004589
MU' 0.261797RADIANS/HR
D' +0.000099RADIANS/HR

PATH OF THE ANNULAR PHASE

Universal Time	Northern Limit Longitude	Northern Limit Latitude	Central Line Longitude	Central Line Latitude	Southern Limit Longitude	Southern Limit Latitude
h m	° ′	° ′	° ′	° ′	° ′	° ′
LIMIT	-135 46	+ 1 47	-135 36	+ 1 31	-135 26	+ 1 15
15 00	-125 46.7	+ 6 16.9	-125 12.8	+ 6 16.9	-124 40.6	+ 6 16.5
15 02	-122 24.1	+ 8 03.3	-121 59.3	+ 8 00.7	-121 35.2	+ 7 58.0
15 04	-119 51.5	+ 9 28.9	-119 31.2	+ 9 25.3	-119 11.4	+ 9 21.7
15 06	-117 45.5	+10 43.2	-117 28.2	+10 39.2	-117 11.1	+10 35.1
15 08	-115 56.7	+11 50.1	-115 41.4	+11 45.8	-115 26.3	+11 41.6
15 10	-114 20.0	+12 51.6	-114 06.3	+12 47.2	-113 52.8	+12 42.9
15 15	-110 54.0	+15 08.8	-110 43.1	+15 04.5	-110 32.4	+15 00.2
15 20	-108 01.5	+17 09.9	-107 52.6	+17 05.7	-107 43.7	+17 01.6
15 25	-105 30.5	+18 59.6	-105 23.0	+18 55.7	-105 15.5	+18 51.9
15 30	-103 14.3	+20 40.9	-103 08.0	+20 37.3	-103 01.6	+20 33.7
15 35	-101 08.9	+22 15.3	-101 03.4	+22 12.0	-100 58.1	+22 08.7
15 40	- 99 11.3	+23 44.2	- 99 06.7	+23 41.1	- 99 02.1	+23 38.1
15 45	- 97 19.6	+25 08.1	- 97 15.7	+25 05.3	- 97 11.7	+25 02.6
15 50	- 95 32.3	+26 27.8	- 95 28.9	+26 25.3	- 95 25.6	+26 22.7
15 55	- 93 48.2	+27 43.6	- 93 45.3	+27 41.3	- 93 42.4	+27 39.0
16 00	- 92 06.2	+28 55.9	- 92 03.7	+28 53.8	- 92 01.2	+28 51.8
16 05	- 90 25.5	+30 04.9	- 90 23.4	+30 03.0	- 90 21.3	+30 01.2
16 10	- 88 45.6	+31 10.8	- 88 43.8	+31 09.1	- 88 42.0	+31 07.4
16 15	- 87 05.7	+32 13.8	- 87 04.2	+32 12.2	- 87 02.7	+32 10.7
16 20	- 85 25.3	+33 13.8	- 85 24.1	+33 12.5	- 85 22.8	+33 11.1
16 25	- 83 44.0	+34 11.1	- 83 42.9	+34 09.8	- 83 41.8	+34 08.5
16 30	- 82 01.3	+35 05.5	- 82 00.4	+35 04.4	- 81 59.5	+35 03.2
16 35	- 80 16.8	+35 57.2	- 80 16.0	+35 56.1	- 80 15.2	+35 55.0
16 40	- 78 30.1	+36 46.1	- 78 29.3	+36 45.0	- 78 28.6	+36 44.0
16 45	- 76 40.7	+37 32.1	- 76 40.1	+37 31.0	- 76 39.4	+37 30.0
16 50	- 74 48.4	+38 15.1	- 74 47.8	+38 14.1	- 74 47.3	+38 13.1
16 55	- 72 52.8	+38 55.2	- 72 52.2	+38 54.1	- 72 51.7	+38 53.1
17 00	- 70 53.4	+39 32.1	- 70 53.0	+39 31.0	- 70 52.5	+39 29.9
17 05	- 68 50.1	+40 05.8	- 68 49.6	+40 04.6	- 68 49.2	+40 03.3
17 10	- 66 42.3	+40 36.0	- 66 41.9	+40 34.7	- 66 41.5	+40 33.3
17 15	- 64 29.7	+41 02.6	- 64 29.4	+41 01.1	- 64 29.1	+40 59.6
17 20	- 62 12.0	+41 25.4	- 62 11.8	+41 23.7	- 62 11.5	+41 21.9
17 25	- 59 48.6	+41 44.1	- 59 48.5	+41 42.1	- 59 48.4	+41 40.1
17 30	- 57 19.1	+41 58.3	- 57 19.2	+41 56.0	- 57 19.3	+41 53.7
17 35	- 54 43.0	+42 07.8	- 54 43.3	+42 05.2	- 54 43.6	+42 02.5
17 40	- 51 59.5	+42 12.0	- 52 00.1	+42 09.1	- 52 00.7	+42 06.1
17 45	- 49 07.8	+42 10.6	- 49 08.9	+42 07.2	- 49 09.9	+42 03.8
17 50	- 46 07.0	+42 02.8	- 46 08.6	+41 58.9	- 46 10.2	+41 55.1
17 55	- 42 55.6	+41 47.8	- 42 57.9	+41 43.5	- 43 00.2	+41 39.2
18 00	- 39 31.6	+41 24.6	- 39 34.9	+41 19.7	- 39 38.2	+41 14.9
18 05	- 35 52.4	+40 51.6	- 35 56.9	+40 46.3	- 36 01.3	+40 41.0
18 10	- 31 53.5	+40 06.8	- 31 59.6	+40 01.0	- 32 05.7	+39 55.2
18 15	- 27 27.7	+39 06.7	- 27 36.1	+39 00.4	- 27 44.4	+38 54.2
18 20	- 22 21.4	+37 45.2	- 22 33.2	+37 38.7	- 22 44.8	+37 32.2
18 22	- 20 01.8	+37 04.0	- 20 15.5	+36 57.5	- 20 29.0	+36 51.1
18 24	- 17 27.6	+36 15.9	- 17 43.7	+36 09.6	- 17 59.6	+36 03.4
18 26	- 14 32.3	+35 18.0	- 14 52.1	+35 12.3	- 15 11.3	+35 06.5
18 28	- 11 03.5	+34 05.2	- 11 28.9	+34 00.7	- 11 53.4	+33 56.1
18 30	- 6 26.3	+32 23.0	- 7 04.2	+32 22.2	- 7 39.8	+32 20.8
18 32	.. .. .	.. .. .	+ 2 58.0	+28 21.9	- 0 01.9	+29 17.8
LIMIT	+ 3 54	+28 17	+ 3 43	+28 03	+ 3 32	+27 49

ANNULAR SOLAR ECLIPSE OF 30 MAY 1984

SURFACE PATH OF THE ANNULAR PHASE OVER LAND

Longitude	Latitude of			Universal Time at			On Central Line			
	Northern Limit	Central Line	Southern Limit	Northern Limit	Central Line	Southern Limit	Maximum Duration	Path Width	Sun's Alt.	Sun's Az.
° ′	° ′	° ′	° ′	h m s	h m s	h m s	m s	km	°	°
-105 00.0	+19 22.1	+19 12.9	+19 03.6	15 26 04.8	15 25 49.2	15 25 33.5	0 31.8	27	41	77
-104 30.0	+19 44.4	+19 35.4	+19 26.3	15 27 09.9	15 26 54.5	15 26 39.1	0 31.1	26	41	78
-104 00.0	+20 06.7	+19 57.9	+19 49.1	15 28 16.3	15 28 01.2	15 27 46.0	0 30.5	25	42	78
-103 30.0	+20 29.1	+20 20.6	+20 12.0	15 29 24.1	15 29 09.3	15 28 54.3	0 29.8	25	43	79
-103 00.0	+20 51.6	+20 43.3	+20 35.0	15 30 33.2	15 30 18.6	15 30 03.9	0 29.1	24	44	79
-102 30.0	+21 14.2	+21 06.1	+20 58.0	15 31 43.5	15 31 29.2	15 31 14.8	0 28.5	23	45	80
-102 00.0	+21 36.7	+21 28.9	+21 21.0	15 32 55.1	15 32 41.1	15 32 27.0	0 27.8	22	45	80
-101 30.0	+21 59.4	+21 51.8	+21 44.1	15 34 08.0	15 33 54.3	15 33 40.5	0 27.2	22	46	81
-101 00.0	+22 22.0	+22 14.7	+22 07.2	15 35 22.1	15 35 08.7	15 34 55.2	0 26.5	21	47	81
-100 30.0	+22 44.7	+22 37.6	+22 30.4	15 36 37.3	15 36 24.3	15 36 11.1	0 25.8	20	48	82
-100 00.0	+23 07.4	+23 00.5	+22 53.5	15 37 53.7	15 37 41.0	15 37 28.1	0 25.2	20	49	83
-99 30.0	+23 30.0	+23 23.3	+23 16.6	15 39 11.2	15 38 58.8	15 38 46.3	0 24.5	19	49	83
-99 00.0	+23 52.7	+23 46.2	+23 39.7	15 40 29.8	15 40 17.8	15 40 05.6	0 23.9	18	50	84
-98 30.0	+24 15.3	+24 09.0	+24 02.7	15 41 49.5	15 41 37.7	15 41 25.9	0 23.2	18	51	85
-98 00.0	+24 37.9	+24 31.8	+24 25.7	15 43 10.1	15 42 58.7	15 42 47.2	0 22.6	17	52	85
-97 30.0	+25 00.4	+24 54.5	+24 48.6	15 44 31.7	15 44 20.7	15 44 09.5	0 22.0	17	53	86
-97 00.0	+25 22.8	+25 17.2	+25 11.5	15 45 54.2	15 45 43.5	15 45 32.7	0 21.3	16	53	87
-96 30.0	+25 45.1	+25 39.7	+25 34.2	15 47 17.6	15 47 07.2	15 46 56.8	0 20.7	15	54	88
-96 00.0	+26 07.4	+26 02.1	+25 56.9	15 48 41.8	15 48 31.8	15 48 21.7	0 20.1	15	55	89
-95 30.0	+26 29.5	+26 24.5	+26 19.4	15 50 06.7	15 49 57.1	15 49 47.3	0 19.5	14	56	89
-95 00.0	+26 51.5	+26 46.7	+26 41.8	15 51 32.4	15 51 23.1	15 51 13.7	0 18.9	14	56	90
-94 30.0	+27 13.4	+27 08.7	+27 04.0	15 52 58.7	15 52 49.7	15 52 40.7	0 18.3	13	57	91
-94 00.0	+27 35.1	+27 30.6	+27 26.1	15 54 25.6	15 54 17.0	15 54 08.3	0 17.7	13	58	92
-93 30.0	+27 56.6	+27 52.3	+27 48.0	15 55 53.1	15 55 44.8	15 55 36.5	0 17.2	12	59	93
-93 00.0	+28 18.0	+28 13.9	+28 09.8	15 57 21.1	15 57 13.2	15 57 05.2	0 16.6	12	59	94
-92 30.0	+28 39.2	+28 35.3	+28 31.3	15 58 49.5	15 58 41.9	15 58 34.3	0 16.1	11	60	96
-92 00.0	+29 00.2	+28 56.4	+28 52.6	16 00 18.4	16 00 11.1	16 00 03.7	0 15.5	11	61	97
-91 30.0	+29 21.0	+29 17.4	+29 13.7	16 01 47.6	16 01 40.6	16 01 33.6	0 15.0	11	62	98
-91 00.0	+29 41.6	+29 38.1	+29 34.6	16 03 17.0	16 03 10.4	16 03 03.6	0 14.5	10	62	99
-90 30.0	+30 01.9	+29 58.6	+29 55.3	16 04 46.7	16 04 40.4	16 04 34.0	0 14.0	10	63	101
-90 22.5	+30 07.0	+30 03.7	+30 00.4	16 05 09.2	16 05 02.9	16 04 56.6	0 13.9	10	63	101
-90 15.0	+30 12.0	+30 08.7	+30 05.5	16 05 31.7	16 05 25.4	16 05 19.2	0 13.8	10	63	101
-90 07.5	+30 17.0	+30 13.8	+30 10.6	16 05 54.1	16 05 48.0	16 05 41.8	0 13.7	9	64	102
-90 00.0	+30 22.0	+30 18.8	+30 15.6	16 06 16.6	16 06 10.5	16 06 04.4	0 13.5	9	64	102
-89 52.5	+30 27.0	+30 23.9	+30 20.7	16 06 39.1	16 06 33.1	16 06 27.1	0 13.4	9	64	102
-89 45.0	+30 32.0	+30 28.9	+30 25.7	16 07 01.6	16 06 55.7	16 06 49.7	0 13.3	9	64	103
-89 37.5	+30 37.0	+30 33.9	+30 30.8	16 07 24.1	16 07 18.3	16 07 12.4	0 13.2	9	64	103
-89 30.0	+30 41.9	+30 38.8	+30 35.8	16 07 46.6	16 07 40.9	16 07 35.0	0 13.1	9	64	104
-89 22.5	+30 46.8	+30 43.8	+30 40.8	16 08 09.2	16 08 03.4	16 07 57.7	0 13.0	9	65	104
-89 15.0	+30 51.7	+30 48.7	+30 45.8	16 08 31.7	16 08 26.0	16 08 20.4	0 12.9	9	65	104
-89 07.5	+30 56.6	+30 53.7	+30 50.7	16 08 54.2	16 08 48.6	16 08 43.0	0 12.7	9	65	105
-89 00.0	+31 01.5	+30 58.6	+30 55.7	16 09 16.8	16 09 11.2	16 09 05.7	0 12.6	9	65	105
-88 52.5	+31 06.4	+31 03.5	+31 00.6	16 09 39.3	16 09 33.8	16 09 28.4	0 12.5	9	65	105
-88 45.0	+31 11.2	+31 08.4	+31 05.5	16 10 01.8	16 09 56.5	16 09 51.0	0 12.4	8	65	106
-88 37.5	+31 16.0	+31 13.2	+31 10.4	16 10 24.4	16 10 19.1	16 10 13.7	0 12.3	8	65	106
-88 30.0	+31 20.9	+31 18.1	+31 15.3	16 10 46.9	16 10 41.7	16 10 36.4	0 12.2	8	66	107
-88 22.5	+31 25.7	+31 22.9	+31 20.1	16 11 09.5	16 11 04.3	16 10 59.1	0 12.1	8	66	107
-88 15.0	+31 30.4	+31 27.7	+31 25.0	16 11 32.0	16 11 26.9	16 11 21.7	0 12.0	8	66	107
-88 07.5	+31 35.2	+31 32.5	+31 29.8	16 11 54.5	16 11 49.5	16 11 44.4	0 11.9	8	66	108
-88 00.0	+31 39.9	+31 37.3	+31 34.6	16 12 17.1	16 12 12.1	16 12 07.0	0 11.8	8	66	108
-87 52.5	+31 44.7	+31 42.0	+31 39.4	16 12 39.6	16 12 34.7	16 12 29.7	0 11.7	8	66	109
-87 45.0	+31 49.4	+31 46.8	+31 44.1	16 13 02.1	16 12 57.2	16 12 52.3	0 11.6	8	67	109
-87 37.5	+31 54.1	+31 51.5	+31 48.9	16 13 24.7	16 13 19.8	16 13 15.0	0 11.5	8	67	110
-87 30.0	+31 58.8	+31 56.2	+31 53.6	16 13 47.2	16 13 42.4	16 13 37.6	0 11.4	8	67	110
-87 22.5	+32 03.4	+32 00.9	+31 58.3	16 14 09.7	16 14 05.0	16 14 00.3	0 11.3	8	67	110
-87 15.0	+32 08.1	+32 05.5	+32 03.0	16 14 32.2	16 14 27.5	16 14 22.9	0 11.2	8	67	111
-87 07.5	+32 12.7	+32 10.2	+32 07.7	16 14 54.7	16 14 50.1	16 14 45.5	0 11.1	7	67	111
-87 00.0	+32 17.3	+32 14.8	+32 12.4	16 15 17.2	16 15 12.7	16 15 08.1	0 11.0	7	67	112
-86 52.5	+32 21.9	+32 19.4	+32 17.0	16 15 39.7	16 15 35.2	16 15 30.7	0 10.9	7	68	112
-86 45.0	+32 26.4	+32 24.0	+32 21.6	16 16 02.1	16 15 57.7	16 15 53.3	0 10.8	7	68	113
-86 37.5	+32 31.0	+32 28.6	+32 26.2	16 16 24.6	16 16 20.2	16 16 15.9	0 10.7	7	68	113
-86 30.0	+32 35.5	+32 33.2	+32 30.8	16 16 47.0	16 16 42.7	16 16 38.4	0 10.6	7	68	114
-86 22.5	+32 40.0	+32 37.7	+32 35.4	16 17 09.5	16 17 05.2	16 17 01.0	0 10.5	7	68	114
-86 15.0	+32 44.5	+32 42.2	+32 39.9	16 17 31.9	16 17 27.7	16 17 23.5	0 10.4	7	68	115
-86 07.5	+32 49.0	+32 46.7	+32 44.5	16 17 54.3	16 17 50.2	16 17 46.0	0 10.4	7	68	115

SURFACE PATH OF THE ANNULAR PHASE OVER LAND

Longitude	Latitude of			Universal Time at			On Central Line		Sun's	
	Northern Limit	Central Line	Southern Limit	Northern Limit	Central Line	Southern Limit	Maximum Duration	Path Width	Alt.	Az.
° ′	° ′	° ′	° ′	h m s	h m s	h m s	m s	km	°	°
- 86 00.0	+32 53.5	+32 51.2	+32 49.0	16 18 16.7	16 18 12.7	16 18 08.6	0 10.3	7	69	116
- 85 52.5	+32 57.9	+32 55.7	+32 53.4	16 18 39.1	16 18 35.1	16 18 31.1	0 10.2	7	69	116
- 85 45.0	+33 02.3	+33 00.1	+32 57.9	16 19 01.5	16 18 57.5	16 18 53.5	0 10.1	7	69	117
- 85 37.5	+33 06.8	+33 04.6	+33 02.4	16 19 23.9	16 19 19.9	16 19 16.0	0 10.0	7	69	117
- 85 30.0	+33 11.1	+33 09.0	+33 06.8	16 19 46.2	16 19 42.3	16 19 38.5	0 09.9	7	69	118
- 85 22.5	+33 15.5	+33 13.4	+33 11.2	16 20 08.6	16 20 04.7	16 20 00.9	0 09.9	7	69	118
- 85 15.0	+33 19.9	+33 17.7	+33 15.6	16 20 30.9	16 20 27.1	16 20 23.3	0 09.8	6	69	119
- 85 07.5	+33 24.2	+33 22.1	+33 20.0	16 20 53.2	16 20 49.4	16 20 45.7	0 09.7	6	69	119
- 85 00.0	+33 28.5	+33 26.4	+33 24.3	16 21 15.5	16 21 11.8	16 21 08.1	0 09.6	6	70	120
- 84 52.5	+33 32.8	+33 30.7	+33 28.7	16 21 37.7	16 21 34.1	16 21 30.4	0 09.5	6	70	120
- 84 45.0	+33 37.1	+33 35.0	+33 33.0	16 22 00.0	16 21 56.4	16 21 52.8	0 09.5	6	70	121
- 84 37.5	+33 41.3	+33 39.3	+33 37.3	16 22 22.2	16 22 18.7	16 22 15.1	0 09.4	6	70	121
- 84 30.0	+33 45.6	+33 43.6	+33 41.6	16 22 44.4	16 22 40.9	16 22 37.4	0 09.3	6	70	122
- 84 22.5	+33 49.8	+33 47.8	+33 45.8	16 23 06.6	16 23 03.2	16 22 59.7	0 09.2	6	70	122
- 84 15.0	+33 54.0	+33 52.0	+33 50.1	16 23 28.8	16 23 25.4	16 23 21.9	0 09.2	6	70	123
- 84 07.5	+33 58.1	+33 56.2	+33 54.3	16 23 50.9	16 23 47.6	16 23 44.2	0 09.1	6	70	123
- 84 00.0	+34 02.3	+34 00.4	+33 58.5	16 24 13.1	16 24 09.7	16 24 06.4	0 09.0	6	71	124
- 83 52.5	+34 06.4	+34 04.5	+34 02.6	16 24 35.2	16 24 31.9	16 24 28.6	0 09.0	6	71	125
- 83 45.0	+34 10.6	+34 08.7	+34 06.8	16 24 57.3	16 24 54.0	16 24 50.8	0 08.9	6	71	125
- 83 37.5	+34 14.7	+34 12.8	+34 10.9	16 25 19.3	16 25 16.1	16 25 12.9	0 08.8	6	71	126
- 83 30.0	+34 18.8	+34 16.9	+34 15.1	16 25 41.4	16 25 38.2	16 25 35.0	0 08.8	6	71	126
- 83 22.5	+34 22.8	+34 21.0	+34 19.2	16 26 03.4	16 26 00.3	16 25 57.1	0 08.7	6	71	127
- 83 15.0	+34 26.9	+34 25.0	+34 23.2	16 26 25.4	16 26 22.3	16 26 19.2	0 08.6	6	71	128
- 83 07.5	+34 30.9	+34 29.1	+34 27.3	16 26 47.4	16 26 44.3	16 26 41.3	0 08.6	6	71	128
- 83 00.0	+34 34.9	+34 33.1	+34 31.3	16 27 09.3	16 27 06.3	16 27 03.3	0 08.5	6	71	129
- 82 52.5	+34 38.9	+34 37.1	+34 35.3	16 27 31.2	16 27 28.3	16 27 25.3	0 08.4	5	71	129
- 82 45.0	+34 42.8	+34 41.1	+34 39.3	16 27 53.1	16 27 50.2	16 27 47.2	0 08.4	5	72	130
- 82 37.5	+34 46.8	+34 45.1	+34 43.3	16 28 15.0	16 28 12.1	16 28 09.2	0 08.3	5	72	131
- 82 30.0	+34 50.7	+34 49.0	+34 47.3	16 28 36.8	16 28 34.0	16 28 31.1	0 08.3	5	72	131
- 82 22.5	+34 54.6	+34 52.9	+34 51.2	16 28 58.6	16 28 55.8	16 28 53.0	0 08.2	5	72	132
- 82 15.0	+34 58.5	+34 56.8	+34 55.1	16 29 20.4	16 29 17.7	16 29 14.9	0 08.2	5	72	132
- 82 07.5	+35 02.4	+35 00.7	+34 59.0	16 29 42.2	16 29 39.4	16 29 36.7	0 08.1	5	72	133
- 82 00.0	+35 06.2	+35 04.6	+35 02.9	16 30 03.9	16 30 01.2	16 29 58.5	0 08.1	5	72	134
- 81 52.5	+35 10.1	+35 08.4	+35 06.8	16 30 25.7	16 30 23.0	16 30 20.3	0 08.0	5	72	134
- 81 45.0	+35 13.9	+35 12.2	+35 10.6	16 30 47.3	16 30 44.7	16 30 42.0	0 07.9	5	72	135
- 81 37.5	+35 17.7	+35 16.0	+35 14.4	16 31 09.0	16 31 06.4	16 31 03.7	0 07.9	5	72	136
- 81 30.0	+35 21.4	+35 19.8	+35 18.2	16 31 30.6	16 31 28.0	16 31 25.4	0 07.8	5	72	136
- 81 22.5	+35 25.2	+35 23.6	+35 22.0	16 31 52.2	16 31 49.6	16 31 47.1	0 07.8	5	72	137
- 81 15.0	+35 28.9	+35 27.3	+35 25.8	16 32 13.8	16 32 11.2	16 32 08.7	0 07.8	5	73	138
- 81 07.5	+35 32.6	+35 31.1	+35 29.5	16 32 35.3	16 32 32.8	16 32 30.3	0 07.7	5	73	138
- 81 00.0	+35 36.3	+35 34.8	+35 33.2	16 32 56.8	16 32 54.3	16 32 51.9	0 07.7	5	73	139
- 80 52.5	+35 40.0	+35 38.5	+35 36.9	16 33 18.3	16 33 15.8	16 33 13.4	0 07.6	5	73	140
- 80 45.0	+35 43.6	+35 42.1	+35 40.6	16 33 39.7	16 33 37.3	16 33 34.9	0 07.6	5	73	140
- 80 37.5	+35 47.3	+35 45.8	+35 44.2	16 34 01.1	16 33 58.8	16 33 56.4	0 07.5	5	73	141
- 80 30.0	+35 50.9	+35 49.4	+35 47.9	16 34 22.5	16 34 20.2	16 34 17.8	0 07.5	5	73	142
- 80 22.5	+35 54.5	+35 53.0	+35 51.5	16 34 43.9	16 34 41.6	16 34 39.2	0 07.4	5	73	142
- 80 15.0	+35 58.1	+35 56.6	+35 55.1	16 35 05.2	16 35 02.9	16 35 00.6	0 07.4	5	73	143
- 80 07.5	+36 01.6	+36 00.1	+35 58.7	16 35 26.5	16 35 24.2	16 35 21.9	0 07.4	5	73	144
- 80 00.0	+36 05.2	+36 03.7	+36 02.2	16 35 47.7	16 35 45.5	16 35 43.2	0 07.3	5	73	145
- 79 52.5	+36 08.7	+36 07.2	+36 05.8	16 36 09.0	16 36 06.7	16 36 04.5	0 07.3	5	73	145
- 79 45.0	+36 12.2	+36 10.7	+36 09.3	16 36 30.2	16 36 28.0	16 36 25.8	0 07.3	5	73	146
- 79 37.5	+36 15.7	+36 14.2	+36 12.8	16 36 51.3	16 36 49.1	16 36 47.0	0 07.2	5	73	147
- 79 30.0	+36 19.1	+36 17.7	+36 16.3	16 37 12.4	16 37 10.3	16 37 08.1	0 07.2	5	73	147
- 79 22.5	+36 22.6	+36 21.1	+36 19.7	16 37 33.5	16 37 31.4	16 37 29.3	0 07.2	5	73	148
- 79 15.0	+36 26.0	+36 24.6	+36 23.2	16 37 54.6	16 37 52.5	16 37 50.4	0 07.1	5	73	149
- 79 07.5	+36 29.4	+36 28.0	+36 26.6	16 38 15.6	16 38 13.5	16 38 11.5	0 07.1	5	73	150
- 79 00.0	+36 32.8	+36 31.4	+36 30.0	16 38 36.6	16 38 34.6	16 38 32.5	0 07.1	5	73	150
- 78 52.5	+36 36.1	+36 34.7	+36 33.3	16 38 57.6	16 38 55.5	16 38 53.5	0 07.0	4	74	151
- 78 45.0	+36 39.5	+36 38.1	+36 36.7	16 39 18.5	16 39 16.5	16 39 14.5	0 07.0	4	74	152
- 78 37.5	+36 42.8	+36 41.4	+36 40.0	16 39 39.4	16 39 37.4	16 39 35.4	0 07.0	4	74	152
- 78 30.0	+36 46.1	+36 44.7	+36 43.4	16 40 00.2	16 39 58.3	16 39 56.3	0 07.0	4	74	153
- 78 22.5	+36 49.4	+36 48.0	+36 46.7	16 40 21.1	16 40 19.1	16 40 17.1	0 06.9	4	74	154
- 78 15.0	+36 52.6	+36 51.3	+36 49.9	16 40 41.8	16 40 39.9	16 40 38.0	0 06.9	4	74	155
- 78 07.5	+36 55.9	+36 54.5	+36 53.2	16 41 02.6	16 41 00.7	16 40 58.8	0 06.9	4	74	155

SURFACE PATH OF THE ANNULAR PHASE OVER LAND

Longitude	Latitude of Northern Limit	Latitude of Central Line	Latitude of Southern Limit	Universal Time at Northern Limit	Universal Time at Central Line	Universal Time at Southern Limit	On Central Line Maximum Duration	On Central Line Path Width	On Central Line Sun's Alt.	On Central Line Sun's Az.
° ′	° ′	° ′	° ′	h m s	h m s	h m s	m s	km	°	°
-78 00.0	+36 59.1	+36 57.8	+36 56.4	16 41 23.3	16 41 21.4	16 41 19.5	0 06.9	4	74	156
-77 52.5	+37 02.3	+37 01.0	+36 59.7	16 41 44.0	16 41 42.1	16 41 40.2	0 06.8	4	74	157
-77 45.0	+37 05.5	+37 04.2	+37 02.9	16 42 04.6	16 42 02.8	16 42 00.9	0 06.8	4	74	158
-77 37.5	+37 08.7	+37 07.4	+37 06.0	16 42 25.2	16 42 23.4	16 42 21.6	0 06.8	4	74	158
-77 30.0	+37 11.8	+37 10.5	+37 09.2	16 42 45.8	16 42 44.0	16 42 42.2	0 06.8	4	74	159
-77 22.5	+37 15.0	+37 13.7	+37 12.3	16 43 06.3	16 43 04.5	16 43 02.7	0 06.8	4	74	160
-77 15.0	+37 18.1	+37 16.8	+37 15.5	16 43 26.8	16 43 25.0	16 43 23.3	0 06.7	4	74	160
-77 07.5	+37 21.2	+37 19.9	+37 18.6	16 43 47.3	16 43 45.5	16 43 43.8	0 06.7	4	74	161
-77 00.0	+37 24.2	+37 22.9	+37 21.7	16 44 07.7	16 44 06.0	16 44 04.2	0 06.7	4	74	162
-76 52.5	+37 27.3	+37 26.0	+37 24.7	16 44 28.1	16 44 26.4	16 44 24.6	0 06.7	4	74	163
-76 45.0	+37 30.3	+37 29.0	+37 27.8	16 44 48.5	16 44 46.7	16 44 45.0	0 06.7	4	74	163
-76 37.5	+37 33.3	+37 32.1	+37 30.8	16 45 08.8	16 45 07.1	16 45 05.4	0 06.7	4	74	164
-76 30.0	+37 36.3	+37 35.1	+37 33.8	16 45 29.0	16 45 27.4	16 45 25.7	0 06.7	4	74	165
-76 22.5	+37 39.3	+37 38.1	+37 36.8	16 45 49.3	16 45 47.6	16 45 46.0	0 06.7	4	74	166
-76 15.0	+37 42.3	+37 41.0	+37 39.8	16 46 09.5	16 46 07.8	16 46 06.2	0 06.6	4	74	166
-76 07.5	+37 45.2	+37 44.0	+37 42.7	16 46 29.7	16 46 28.0	16 46 26.4	0 06.6	4	74	167
-76 00.0	+37 48.2	+37 46.9	+37 45.6	16 46 49.8	16 46 48.2	16 46 46.5	0 06.6	4	74	168
-75 52.5	+37 51.1	+37 49.8	+37 48.5	16 47 09.9	16 47 08.3	16 47 06.7	0 06.6	4	74	168
-75 45.0	+37 53.9	+37 52.7	+37 51.4	16 47 29.9	16 47 28.3	16 47 26.8	0 06.6	4	74	169
-75 37.5	+37 56.8	+37 55.6	+37 54.3	16 47 50.0	16 47 48.4	16 47 46.8	0 06.6	4	74	170
-75 30.0	+37 59.7	+37 58.4	+37 57.2	16 48 09.9	16 48 08.4	16 48 06.8	0 06.6	4	74	171
-75 22.5	+38 02.5	+38 01.2	+38 00.0	16 48 29.9	16 48 28.3	16 48 26.8	0 06.6	4	74	171
-75 15.0	+38 05.3	+38 04.1	+38 02.8	16 48 49.8	16 48 48.2	16 48 46.7	0 06.6	4	74	172
-75 07.5	+38 08.1	+38 06.9	+38 05.6	16 49 09.7	16 49 08.1	16 49 06.6	0 06.6	4	74	173
-75 00.0	+38 10.9	+38 09.6	+38 08.4	16 49 29.5	16 49 28.0	16 49 26.5	0 06.6	4	74	173
-74 30.0	+38 21.8	+38 20.6	+38 19.3	16 50 48.4	16 50 47.0	16 50 45.5	0 06.6	4	73	176
-74 00.0	+38 32.4	+38 31.2	+38 30.0	16 52 06.7	16 52 05.3	16 52 03.9	0 06.6	4	73	179
-73 30.0	+38 42.8	+38 41.5	+38 40.3	16 53 24.5	16 53 23.1	16 53 21.7	0 06.6	4	73	182
-73 00.0	+38 52.8	+38 51.6	+38 50.3	16 54 41.6	16 54 40.2	16 54 38.9	0 06.7	4	73	184
-72 30.0	+39 02.6	+39 01.3	+39 00.1	16 55 58.1	16 55 56.8	16 55 55.5	0 06.7	4	73	187
-72 00.0	+39 12.1	+39 10.8	+39 09.6	16 57 13.9	16 57 12.7	16 57 11.4	0 06.8	4	73	189
-71 30.0	+39 21.3	+39 20.0	+39 18.8	16 58 29.2	16 58 28.0	16 58 26.8	0 06.9	4	72	191
-71 00.0	+39 30.2	+39 28.9	+39 27.7	16 59 43.8	16 59 42.7	16 59 41.5	0 07.0	4	72	194
-70 30.0	+39 38.9	+39 37.6	+39 36.3	17 00 57.9	17 00 56.7	17 00 55.6	0 07.1	4	72	196
-70 00.0	+39 47.3	+39 46.0	+39 44.7	17 02 11.3	17 02 10.2	17 02 09.1	0 07.2	5	71	198
-69 30.0	+39 55.4	+39 54.1	+39 52.8	17 03 24.1	17 03 23.1	17 03 22.0	0 07.3	5	71	200
-69 00.0	+40 03.2	+40 01.9	+40 00.6	17 04 36.3	17 04 35.3	17 04 34.3	0 07.4	5	71	202
-68 30.0	+40 10.8	+40 09.5	+40 08.1	17 05 47.9	17 05 46.9	17 05 45.9	0 07.6	5	70	204
-68 00.0	+40 18.2	+40 16.8	+40 15.4	17 06 59.0	17 06 58.0	17 06 57.0	0 07.7	5	70	206
-67 30.0	+40 25.3	+40 23.9	+40 22.5	17 08 09.4	17 08 08.4	17 08 07.5	0 07.9	5	70	208
-67 00.0	+40 32.1	+40 30.7	+40 29.2	17 09 19.2	17 09 18.3	17 09 17.4	0 08.0	5	69	210
-66 30.0	+40 38.7	+40 37.2	+40 35.8	17 10 28.4	17 10 27.6	17 10 26.7	0 08.2	5	69	211
-66 00.0	+40 45.0	+40 43.5	+40 42.0	17 11 37.1	17 11 36.2	17 11 35.4	0 08.4	5	68	213
-65 30.0	+40 51.1	+40 49.6	+40 48.1	17 12 45.1	17 12 44.3	17 12 43.6	0 08.6	5	68	215
-65 00.0	+40 57.0	+40 55.4	+40 53.9	17 13 52.6	17 13 51.9	17 13 51.1	0 08.8	6	68	216
-32 00.0	+40 08.1	+40 01.0	+39 53.9	18 09 52.2	18 09 59.6	18 10 07.0	0 31.2	25	36	270
-31 30.0	+40 01.9	+39 54.7	+39 47.5	18 10 28.0	18 10 35.5	18 10 43.1	0 31.6	26	35	270
-31 00.0	+39 55.6	+39 48.2	+39 40.8	18 11 03.3	18 11 11.0	18 11 18.8	0 32.0	26	35	271
-30 30.0	+39 49.1	+39 41.6	+39 34.0	18 11 38.2	18 11 46.1	18 11 54.0	0 32.4	27	34	271
-30 00.0	+39 42.4	+39 34.8	+39 27.1	18 12 12.6	18 12 20.6	18 12 28.7	0 32.8	27	34	272
-29 30.0	+39 35.7	+39 27.9	+39 20.1	18 12 46.5	18 12 54.7	18 13 03.0	0 33.2	28	33	272
-29 00.0	+39 28.8	+39 20.8	+39 12.9	18 13 20.0	18 13 28.4	18 13 36.9	0 33.6	28	33	273
-28 30.0	+39 21.7	+39 13.7	+39 05.6	18 13 53.0	18 14 01.6	18 14 10.2	0 34.0	29	32	273
-28 00.0	+39 14.6	+39 06.4	+38 58.1	18 14 25.5	18 14 34.3	18 14 43.1	0 34.4	29	32	274
-27 30.0	+39 07.3	+38 58.9	+38 50.6	18 14 57.6	18 15 06.6	18 15 15.6	0 34.7	29	31	274
-27 00.0	+38 59.9	+38 51.4	+38 42.9	18 15 29.2	18 15 38.4	18 15 47.5	0 35.1	30	31	275
-9 00.0	+33 20.4	+33 06.0	+32 51.4	18 28 59.1	18 29 12.7	18 29 26.3	0 48.4	49	13	288
-8 30.0	+33 09.3	+32 54.7	+32 40.0	18 29 12.1	18 29 25.7	18 29 39.4	0 48.7	49	12	288
-8 00.0	+32 58.2	+32 43.4	+32 28.5	18 29 24.6	18 29 38.2	18 29 51.9	0 49.0	50	12	289
-7 30.0	+32 47.0	+32 32.0	+32 17.0	18 29 36.5	18 29 50.2	18 30 04.0	0 49.4	51	11	289
-7 00.0	+32 35.7	+32 20.6	+32 05.3	18 29 47.9	18 30 01.7	18 30 15.5	0 49.7	51	11	289

CORRECTIONS FOR ELEVATION ABOVE SEA LEVEL

Multiply by thousands of feet elevation and apply to predicted latitudes and times taken from other tables in this Circular.

Longitude	Latitude	U.T.	Longitude	Latitude	U.T.	Longitude	Latitude	U.T.
° ′	″	s	° ′	″	s	° ′	″	s
-105 00.0	-6.299	-0.426	- 86 00.0	-4.118	-0.207	- 78 00.0	-3.225	-0.067
-104 30.0	-6.279	-0.425	- 85 52.5	-4.101	-0.205	- 77 52.5	-3.215	-0.065
-104 00.0	-6.256	-0.424	- 85 45.0	-4.084	-0.203	- 77 45.0	-3.204	-0.063
-103 30.0	-6.230	-0.422	- 85 37.5	-4.067	-0.201	- 77 37.5	-3.194	-0.061
-103 00.0	-6.202	-0.420	- 85 30.0	-4.051	-0.199	- 77 30.0	-3.184	-0.059
-102 30.0	-6.171	-0.417	- 85 22.5	-4.034	-0.196	- 77 22.5	-3.174	-0.057
-102 00.0	-6.137	-0.415	- 85 15.0	-4.018	-0.194	- 77 15.0	-3.164	-0.055
-101 30.0	-6.100	-0.412	- 85 07.5	-4.001	-0.192	- 77 07.5	-3.154	-0.053
-101 00.0	-6.061	-0.409						
-100 30.0	-6.019	-0.406	- 85 00.0	-3.985	-0.190	- 77 00.0	-3.144	-0.051
			- 84 52.5	-3.969	-0.187	- 76 52.5	-3.134	-0.049
-100 00.0	-5.975	-0.402	- 84 45.0	-3.952	-0.185	- 76 45.0	-3.125	-0.047
- 99 30.0	-5.928	-0.398	- 84 37.5	-3.936	-0.183	- 76 37.5	-3.115	-0.045
- 99 00.0	-5.878	-0.394	- 84 30.0	-3.920	-0.181	- 76 30.0	-3.106	-0.043
- 98 30.0	-5.826	-0.389	- 84 22.5	-3.904	-0.178	- 76 22.5	-3.097	-0.041
- 98 00.0	-5.772	-0.385	- 84 15.0	-3.888	-0.176	- 76 15.0	-3.088	-0.039
- 97 30.0	-5.715	-0.380	- 84 07.5	-3.873	-0.174	- 76 07.5	-3.079	-0.037
- 97 00.0	-5.657	-0.375						
- 96 30.0	-5.596	-0.369	- 84 00.0	-3.857	-0.172	- 76 00.0	-3.070	-0.035
- 96 00.0	-5.533	-0.363	- 83 52.5	-3.842	-0.169	- 75 52.5	-3.061	-0.033
- 95 30.0	-5.469	-0.357	- 83 45.0	-3.826	-0.167	- 75 45.0	-3.052	-0.031
			- 83 37.5	-3.811	-0.165	- 75 37.5	-3.044	-0.029
- 95 00.0	-5.403	-0.351	- 83 30.0	-3.795	-0.163	- 75 30.0	-3.035	-0.027
- 94 30.0	-5.335	-0.344	- 83 22.5	-3.780	-0.161	- 75 22.5	-3.027	-0.025
- 94 00.0	-5.266	-0.338	- 83 15.0	-3.765	-0.158	- 75 15.0	-3.018	-0.023
- 93 30.0	-5.196	-0.331	- 83 07.5	-3.750	-0.156	- 75 07.5	-3.010	-0.021
- 93 00.0	-5.125	-0.324						
- 92 30.0	-5.053	-0.316	- 83 00.0	-3.735	-0.154	- 75 00.0	-3.002	-0.019
- 92 00.0	-4.981	-0.309	- 82 52.5	-3.720	-0.152	- 74 30.0	-2.971	-0.011
- 91 30.0	-4.908	-0.301	- 82 45.0	-3.706	-0.149	- 74 00.0	-2.941	-0.003
- 91 00.0	-4.835	-0.293	- 82 37.5	-3.691	-0.147	- 73 30.0	-2.913	0.004
- 90 30.0	-4.761	-0.285	- 82 30.0	-3.677	-0.145	- 73 00.0	-2.886	0.012
			- 82 22.5	-3.662	-0.143	- 72 30.0	-2.861	0.019
- 90 22.5	-4.743	-0.283	- 82 15.0	-3.648	-0.141	- 72 00.0	-2.837	0.027
- 90 15.0	-4.725	-0.281	- 82 07.5	-3.634	-0.138	- 71 30.0	-2.815	0.034
- 90 07.5	-4.706	-0.279				- 71 00.0	-2.794	0.041
			- 82 00.0	-3.620	-0.136	- 70 30.0	-2.775	0.048
- 90 00.0	-4.688	-0.277	- 81 52.5	-3.606	-0.134			
- 89 52.5	-4.670	-0.275	- 81 45.0	-3.592	-0.132	- 70 00.0	-2.757	0.055
- 89 45.0	-4.651	-0.273	- 81 37.5	-3.578	-0.129	- 69 30.0	-2.740	0.062
- 89 37.5	-4.633	-0.270	- 81 30.0	-3.564	-0.127	- 69 00.0	-2.725	0.068
- 89 30.0	-4.615	-0.268	- 81 22.5	-3.551	-0.125	- 68 30.0	-2.711	0.075
- 89 22.5	-4.596	-0.266	- 81 15.0	-3.537	-0.123	- 68 00.0	-2.699	0.082
- 89 15.0	-4.578	-0.264	- 81 07.5	-3.524	-0.121	- 67 30.0	-2.687	0.088
- 89 07.5	-4.560	-0.262				- 67 00.0	-2.677	0.094
			- 81 00.0	-3.511	-0.119	- 66 30.0	-2.668	0.101
- 89 00.0	-4.542	-0.260	- 80 52.5	-3.498	-0.116	- 66 00.0	-2.660	0.107
- 88 52.5	-4.523	-0.258	- 80 45.0	-3.485	-0.114	- 65 30.0	-2.653	0.113
- 88 45.0	-4.505	-0.256	- 80 37.5	-3.472	-0.112			
- 88 37.5	-4.487	-0.253	- 80 30.0	-3.459	-0.110	- 65 00.0	-2.648	0.119
- 88 30.0	-4.469	-0.251	- 80 22.5	-3.446	-0.108			
- 88 22.5	-4.451	-0.249	- 80 15.0	-3.434	-0.105	- 32 00.0	-3.764	0.360
- 88 15.0	-4.433	-0.247	- 80 07.5	-3.421	-0.103	- 31 30.0	-3.792	0.361
- 88 07.5	-4.415	-0.245				- 31 00.0	-3.821	0.363
			- 80 00.0	-3.409	-0.101	- 30 30.0	-3.850	0.364
- 88 00.0	-4.397	-0.243	- 79 52.5	-3.396	-0.099	- 30 00.0	-3.878	0.366
- 87 52.5	-4.379	-0.241	- 79 45.0	-3.384	-0.097	- 29 30.0	-3.907	0.367
- 87 45.0	-4.361	-0.238	- 79 37.5	-3.372	-0.095	- 29 00.0	-3.936	0.368
- 87 37.5	-4.344	-0.236	- 79 30.0	-3.360	-0.093	- 28 30.0	-3.965	0.369
- 87 30.0	-4.326	-0.234	- 79 22.5	-3.348	-0.090	- 28 00.0	-3.993	0.370
- 87 22.5	-4.308	-0.232	- 79 15.0	-3.337	-0.088	- 27 30.0	-4.022	0.371
- 87 15.0	-4.291	-0.230	- 79 07.5	-3.325	-0.086			
- 87 07.5	-4.273	-0.227				- 27 00.0	-4.050	0.372
			- 79 00.0	-3.314	-0.084			
- 87 00.0	-4.256	-0.225	- 78 52.5	-3.302	-0.082	- 9 00.0	-4.922	0.369
- 86 52.5	-4.238	-0.223	- 78 45.0	-3.291	-0.080	- 8 30.0	-4.937	0.369
- 86 45.0	-4.221	-0.221	- 78 37.5	-3.280	-0.078	- 8 00.0	-4.955	0.367
- 86 37.5	-4.203	-0.219	- 78 30.0	-3.269	-0.076	- 7 30.0	-4.971	0.366
- 86 30.0	-4.186	-0.216	- 78 22.5	-3.258	-0.073	- 7 00.0	-4.984	0.366
- 86 22.5	-4.169	-0.214	- 78 15.0	-3.247	-0.071			
- 86 15.0	-4.152	-0.212	- 78 07.5	-3.236	-0.069			
- 86 07.5	-4.135	-0.210						

PATH OF THE ANNULAR PHASE OVER LAND AT FLYING ALTITUDES

Longitude	Latitude of Northern Limit at			Latitude of Central Line at			Latitude of Southern Limit at		
	Sea Level	10,000 Ft.	40,000 Ft.	Sea Level	10,000 Ft.	40,000 Ft.	Sea Level	10,000 Ft.	40,000 Ft.
° '	° '	° '	° '	° '	° '	° '	° '	° '	° '
-105 00.0	+19 22.1	+19 21.1	+19 17.9	+19 12.9	+19 11.8	+19 08.7	+19 03.6	+19 02.6	+18 59.4
-104 30.0	+19 44.4	+19 43.3	+19 40.2	+19 35.4	+19 34.3	+19 31.2	+19 26.3	+19 25.3	+19 22.2
-104 00.0	+20 06.7	+20 05.7	+20 02.5	+19 57.9	+19 56.9	+19 53.8	+19 49.1	+19 48.1	+19 45.0
-103 30.0	+20 29.1	+20 28.1	+20 25.0	+20 20.6	+20 19.6	+20 16.4	+20 12.0	+20 11.0	+20 07.9
-103 00.0	+20 51.6	+20 50.6	+20 47.5	+20 43.3	+20 42.3	+20 39.2	+20 35.0	+20 33.9	+20 30.9
-102 30.0	+21 14.2	+21 13.1	+21 10.0	+21 06.1	+21 05.1	+21 02.0	+20 58.0	+20 57.0	+20 53.9
-102 00.0	+21 36.7	+21 35.7	+21 32.6	+21 28.9	+21 27.9	+21 24.8	+21 21.0	+21 20.0	+21 17.0
-101 30.0	+21 59.4	+21 58.4	+21 55.3	+21 51.8	+21 50.8	+21 47.7	+21 44.1	+21 43.1	+21 40.1
-101 00.0	+22 22.0	+22 21.0	+22 18.0	+22 14.7	+22 13.6	+22 10.6	+22 07.2	+22 06.2	+22 03.2
-100 30.0	+22 44.7	+22 43.7	+22 40.7	+22 37.6	+22 36.6	+22 33.5	+22 30.4	+22 29.4	+22 26.4
-100 00.0	+23 07.4	+23 06.4	+23 03.4	+23 00.5	+22 59.5	+22 56.5	+22 53.5	+22 52.5	+22 49.5
- 99 30.0	+23 30.0	+23 29.1	+23 26.1	+23 23.3	+23 22.4	+23 19.4	+23 16.6	+23 15.6	+23 12.7
- 99 00.0	+23 52.7	+23 51.7	+23 48.7	+23 46.2	+23 45.2	+23 42.3	+23 39.7	+23 38.7	+23 35.8
- 98 30.0	+24 15.3	+24 14.3	+24 11.4	+24 09.0	+24 08.1	+24 05.1	+24 02.7	+24 01.8	+23 58.9
- 98 00.0	+24 37.9	+24 36.9	+24 34.0	+24 31.8	+24 30.8	+24 28.0	+24 25.7	+24 24.8	+24 21.9
- 97 30.0	+25 00.4	+24 59.4	+24 56.5	+24 54.5	+24 53.6	+24 50.7	+24 48.6	+24 47.7	+24 44.9
- 97 00.0	+25 22.8	+25 21.8	+25 19.0	+25 17.2	+25 16.2	+25 13.4	+25 11.5	+25 10.6	+25 07.7
- 96 30.0	+25 45.1	+25 44.2	+25 41.4	+25 39.7	+25 38.8	+25 36.0	+25 34.2	+25 33.3	+25 30.5
- 96 00.0	+26 07.4	+26 06.4	+26 03.7	+26 02.1	+26 01.2	+25 58.4	+25 56.9	+25 56.0	+25 53.2
- 95 30.0	+26 29.5	+26 28.6	+26 25.8	+26 24.5	+26 23.6	+26 20.8	+26 19.4	+26 18.5	+26 15.8
- 95 00.0	+26 51.5	+26 50.6	+26 47.9	+26 46.7	+26 45.8	+26 43.1	+26 41.8	+26 40.9	+26 38.2
- 94 30.0	+27 13.4	+27 12.5	+27 09.8	+27 08.7	+27 07.8	+27 05.2	+27 04.0	+27 03.2	+27 00.5
- 94 00.0	+27 35.1	+27 34.2	+27 31.5	+27 30.6	+27 29.7	+27 27.1	+27 26.1	+27 25.3	+27 22.6
- 93 30.0	+27 56.6	+27 55.8	+27 53.1	+27 52.3	+27 51.5	+27 48.9	+27 48.0	+27 47.2	+27 44.6
- 93 00.0	+28 18.0	+28 17.2	+28 14.6	+28 13.9	+28 13.0	+28 10.5	+28 09.8	+28 08.9	+28 06.4
- 92 30.0	+28 39.2	+28 38.4	+28 35.8	+28 35.3	+28 34.4	+28 31.9	+28 31.3	+28 30.5	+28 28.0
- 92 00.0	+29 00.2	+28 59.4	+28 56.9	+28 56.4	+28 55.6	+28 53.1	+28 52.6	+28 51.8	+28 49.3
- 91 30.0	+29 21.0	+29 20.2	+29 17.7	+29 17.4	+29 16.6	+29 14.1	+29 13.7	+29 12.9	+29 10.5
- 91 00.0	+29 41.6	+29 40.8	+29 38.3	+29 38.1	+29 37.3	+29 34.9	+29 34.6	+29 33.8	+29 31.4
- 90 30.0	+30 01.9	+30 01.1	+29 58.7	+29 58.6	+29 57.8	+29 55.4	+29 55.3	+29 54.5	+29 52.1
- 90 22.5	+30 07.0	+30 06.2	+30 03.8	+30 03.7	+30 02.9	+30 00.5	+30 00.4	+29 59.6	+29 57.2
- 90 15.0	+30 12.0	+30 11.2	+30 08.8	+30 08.7	+30 08.0	+30 05.6	+30 05.5	+30 04.7	+30 02.4
- 90 07.5	+30 17.0	+30 16.2	+30 13.9	+30 13.8	+30 13.0	+30 10.7	+30 10.6	+30 09.8	+30 07.5
- 90 00.0	+30 22.0	+30 21.2	+30 18.9	+30 18.8	+30 18.1	+30 15.7	+30 15.6	+30 14.9	+30 12.6
- 89 52.5	+30 27.0	+30 26.2	+30 23.9	+30 23.9	+30 23.1	+30 20.8	+30 20.7	+30 19.9	+30 17.6
- 89 45.0	+30 32.0	+30 31.2	+30 28.9	+30 28.9	+30 28.1	+30 25.8	+30 25.7	+30 25.0	+30 22.7
- 89 37.5	+30 37.0	+30 36.2	+30 33.8	+30 33.9	+30 33.1	+30 30.8	+30 30.8	+30 30.0	+30 27.7
- 89 30.0	+30 41.9	+30 41.1	+30 38.8	+30 38.8	+30 38.1	+30 35.8	+30 35.8	+30 35.0	+30 32.7
- 89 22.5	+30 46.8	+30 46.1	+30 43.7	+30 43.8	+30 43.0	+30 40.7	+30 40.8	+30 40.0	+30 37.7
- 89 15.0	+30 51.7	+30 51.0	+30 48.7	+30 48.7	+30 48.0	+30 45.7	+30 45.8	+30 45.0	+30 42.7
- 89 07.5	+30 56.6	+30 55.9	+30 53.6	+30 53.7	+30 52.9	+30 50.6	+30 50.7	+30 50.0	+30 47.7
- 89 00.0	+31 01.5	+31 00.7	+30 58.4	+30 58.6	+30 57.8	+30 55.6	+30 55.7	+30 54.9	+30 52.7
- 88 52.5	+31 06.4	+31 05.6	+31 03.3	+31 03.5	+31 02.7	+31 00.5	+31 00.6	+30 59.8	+30 57.6
- 88 45.0	+31 11.2	+31 10.5	+31 08.2	+31 08.4	+31 07.6	+31 05.4	+31 05.5	+31 04.7	+31 02.5
- 88 37.5	+31 16.0	+31 15.3	+31 13.0	+31 13.2	+31 12.5	+31 10.2	+31 10.4	+31 09.6	+31 07.4
- 88 30.0	+31 20.9	+31 20.1	+31 17.8	+31 18.1	+31 17.3	+31 15.1	+31 15.3	+31 14.5	+31 12.3
- 88 22.5	+31 25.7	+31 24.9	+31 22.7	+31 22.9	+31 22.1	+31 19.9	+31 20.1	+31 19.4	+31 17.2
- 88 15.0	+31 30.4	+31 29.7	+31 27.4	+31 27.7	+31 27.0	+31 24.7	+31 25.0	+31 24.2	+31 22.0
- 88 07.5	+31 35.2	+31 34.5	+31 32.2	+31 32.5	+31 31.8	+31 29.5	+31 29.8	+31 29.0	+31 26.9
- 88 00.0	+31 39.9	+31 39.2	+31 37.0	+31 37.3	+31 36.5	+31 34.3	+31 34.6	+31 33.9	+31 31.7
- 87 52.5	+31 44.7	+31 43.9	+31 41.7	+31 42.0	+31 41.3	+31 39.1	+31 39.4	+31 38.6	+31 36.5
- 87 45.0	+31 49.4	+31 48.6	+31 46.4	+31 46.8	+31 46.0	+31 43.9	+31 44.1	+31 43.4	+31 41.3
- 87 37.5	+31 54.1	+31 53.3	+31 51.1	+31 51.5	+31 50.8	+31 48.6	+31 48.9	+31 48.2	+31 46.0
- 87 30.0	+31 58.8	+31 58.0	+31 55.8	+31 56.2	+31 55.5	+31 53.3	+31 53.6	+31 52.9	+31 50.8
- 87 22.5	+32 03.4	+32 02.7	+32 00.5	+32 00.9	+32 00.2	+31 58.0	+31 58.3	+31 57.6	+31 55.5
- 87 15.0	+32 08.1	+32 07.3	+32 05.2	+32 05.5	+32 04.8	+32 02.7	+32 03.0	+32 02.3	+32 00.2
- 87 07.5	+32 12.7	+32 12.0	+32 09.8	+32 10.2	+32 09.5	+32 07.3	+32 07.7	+32 07.0	+32 04.9
- 87 00.0	+32 17.3	+32 16.6	+32 14.4	+32 14.8	+32 14.1	+32 12.0	+32 12.4	+32 11.7	+32 09.6
- 86 52.5	+32 21.9	+32 21.2	+32 19.0	+32 19.4	+32 18.7	+32 16.6	+32 17.0	+32 16.3	+32 14.2
- 86 45.0	+32 26.4	+32 25.7	+32 23.6	+32 24.0	+32 23.3	+32 21.2	+32 21.6	+32 20.9	+32 18.8
- 86 37.5	+32 31.0	+32 30.3	+32 28.2	+32 28.6	+32 27.9	+32 25.8	+32 26.2	+32 25.5	+32 23.5
- 86 30.0	+32 35.5	+32 34.8	+32 32.7	+32 33.2	+32 32.5	+32 30.4	+32 30.8	+32 30.1	+32 28.1
- 86 22.5	+32 40.0	+32 39.3	+32 37.2	+32 37.7	+32 37.0	+32 34.9	+32 35.4	+32 34.7	+32 32.6
- 86 15.0	+32 44.5	+32 43.8	+32 41.7	+32 42.2	+32 41.5	+32 39.5	+32 39.9	+32 39.2	+32 37.2
- 86 07.5	+32 49.0	+32 48.3	+32 46.2	+32 46.7	+32 46.0	+32 44.0	+32 44.5	+32 43.8	+32 41.7

PATH OF THE ANNULAR PHASE OVER LAND AT FLYING ALTITUDES

Longitude	Latitude of Northern Limit at			Latitude of Central Line at			Latitude of Southern Limit at		
	Sea Level	10,000 Ft.	40,000 Ft.	Sea Level	10,000 Ft.	40,000 Ft.	Sea Level	10,000 Ft.	40,000 Ft.
° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
- 86 00.0	+32 53.5	+32 52.8	+32 50.7	+32 51.2	+32 50.5	+32 48.5	+32 49.0	+32 48.3	+32 46.3
- 85 52.5	+32 57.9	+32 57.2	+32 55.2	+32 55.7	+32 55.0	+32 53.0	+32 53.4	+32 52.8	+32 50.8
- 85 45.0	+33 02.3	+33 01.7	+32 59.6	+33 00.1	+32 59.5	+32 57.4	+32 57.9	+32 57.2	+32 55.2
- 85 37.5	+33 06.8	+33 06.1	+33 04.0	+33 04.6	+33 03.9	+33 01.8	+33 02.4	+33 01.7	+32 59.7
- 85 30.0	+33 11.1	+33 10.5	+33 08.4	+33 09.0	+33 08.3	+33 06.3	+33 06.8	+33 06.1	+33 04.1
- 85 22.5	+33 15.5	+33 14.8	+33 12.8	+33 13.4	+33 12.7	+33 10.7	+33 11.2	+33 10.6	+33 08.6
- 85 15.0	+33 19.9	+33 19.2	+33 17.1	+33 17.7	+33 17.1	+33 15.1	+33 15.6	+33 14.9	+33 13.0
- 85 07.5	+33 24.2	+33 23.5	+33 21.5	+33 22.1	+33 21.4	+33 19.4	+33 20.0	+33 19.3	+33 17.4
- 85 00.0	+33 28.5	+33 27.8	+33 25.8	+33 26.4	+33 25.8	+33 23.8	+33 24.3	+33 23.7	+33 21.7
- 84 52.5	+33 32.8	+33 32.1	+33 30.1	+33 30.7	+33 30.1	+33 28.1	+33 28.7	+33 28.0	+33 26.1
- 84 45.0	+33 37.1	+33 36.4	+33 34.4	+33 35.0	+33 34.4	+33 32.4	+33 33.0	+33 32.3	+33 30.4
- 84 37.5	+33 41.3	+33 40.7	+33 38.7	+33 39.3	+33 38.6	+33 36.7	+33 37.3	+33 36.6	+33 34.7
- 84 30.0	+33 45.6	+33 44.9	+33 42.9	+33 43.6	+33 42.9	+33 40.9	+33 41.6	+33 40.9	+33 39.0
- 84 22.5	+33 49.8	+33 49.1	+33 47.1	+33 47.8	+33 47.1	+33 45.2	+33 45.8	+33 45.2	+33 43.3
- 84 15.0	+33 54.0	+33 53.3	+33 51.3	+33 52.0	+33 51.4	+33 49.4	+33 50.1	+33 49.4	+33 47.5
- 84 07.5	+33 58.1	+33 57.5	+33 55.5	+33 56.2	+33 55.6	+33 53.6	+33 54.3	+33 53.6	+33 51.7
- 84 00.0	+34 02.3	+34 01.7	+33 59.7	+34 00.4	+33 59.7	+33 57.8	+33 58.5	+33 57.8	+33 55.9
- 83 52.5	+34 06.4	+34 05.8	+34 03.8	+34 04.5	+34 03.9	+34 02.0	+34 02.6	+34 02.0	+34 00.1
- 83 45.0	+34 10.6	+34 09.9	+34 08.0	+34 08.7	+34 08.0	+34 06.1	+34 06.8	+34 06.2	+34 04.3
- 83 37.5	+34 14.7	+34 14.0	+34 12.1	+34 12.8	+34 12.2	+34 10.3	+34 10.9	+34 10.3	+34 08.4
- 83 30.0	+34 18.8	+34 18.1	+34 16.2	+34 16.9	+34 16.3	+34 14.4	+34 15.1	+34 14.4	+34 12.6
- 83 22.5	+34 22.8	+34 22.2	+34 20.3	+34 21.0	+34 20.4	+34 18.5	+34 19.2	+34 18.5	+34 16.7
- 83 15.0	+34 26.9	+34 26.2	+34 24.3	+34 25.0	+34 24.4	+34 22.5	+34 23.2	+34 22.6	+34 20.8
- 83 07.5	+34 30.9	+34 30.2	+34 28.3	+34 29.1	+34 28.5	+34 26.6	+34 27.3	+34 26.7	+34 24.8
- 83 00.0	+34 34.9	+34 34.3	+34 32.4	+34 33.1	+34 32.5	+34 30.6	+34 31.3	+34 30.7	+34 28.9
- 82 52.5	+34 38.9	+34 38.2	+34 36.4	+34 37.1	+34 36.5	+34 34.6	+34 35.3	+34 34.7	+34 32.9
- 82 45.0	+34 42.8	+34 42.2	+34 40.3	+34 41.1	+34 40.5	+34 38.6	+34 39.3	+34 38.7	+34 36.9
- 82 37.5	+34 46.8	+34 46.2	+34 44.3	+34 45.1	+34 44.4	+34 42.6	+34 43.3	+34 42.7	+34 40.9
- 82 30.0	+34 50.7	+34 50.1	+34 48.2	+34 49.0	+34 48.4	+34 46.5	+34 47.3	+34 46.7	+34 44.9
- 82 22.5	+34 54.6	+34 54.0	+34 52.1	+34 52.9	+34 52.3	+34 50.5	+34 51.2	+34 50.6	+34 48.8
- 82 15.0	+34 58.5	+34 57.9	+34 56.0	+34 56.8	+34 56.2	+34 54.4	+34 55.1	+34 54.5	+34 52.7
- 82 07.5	+35 02.4	+35 01.8	+34 59.9	+35 00.7	+35 00.1	+34 58.3	+34 59.0	+34 58.4	+34 56.7
- 82 00.0	+35 06.2	+35 05.6	+35 03.8	+35 04.6	+35 04.0	+35 02.2	+35 02.9	+35 02.3	+35 00.5
- 81 52.5	+35 10.1	+35 09.4	+35 07.6	+35 08.4	+35 07.8	+35 06.0	+35 06.8	+35 06.2	+35 04.4
- 81 45.0	+35 13.9	+35 13.3	+35 11.4	+35 12.2	+35 11.6	+35 09.8	+35 10.6	+35 10.0	+35 08.3
- 81 37.5	+35 17.7	+35 17.1	+35 15.2	+35 16.0	+35 15.4	+35 13.7	+35 14.4	+35 13.8	+35 12.1
- 81 30.0	+35 21.4	+35 20.8	+35 19.0	+35 19.8	+35 19.2	+35 17.4	+35 18.2	+35 17.6	+35 15.9
- 81 22.5	+35 25.2	+35 24.6	+35 22.8	+35 23.6	+35 23.0	+35 21.2	+35 22.0	+35 21.4	+35 19.7
- 81 15.0	+35 28.9	+35 28.3	+35 26.5	+35 27.3	+35 26.7	+35 25.0	+35 25.8	+35 25.2	+35 23.4
- 81 07.5	+35 32.6	+35 32.0	+35 30.2	+35 31.1	+35 30.5	+35 28.7	+35 29.5	+35 28.9	+35 27.2
- 81 00.0	+35 36.3	+35 35.7	+35 33.9	+35 34.8	+35 34.2	+35 32.4	+35 33.2	+35 32.6	+35 30.9
- 80 52.5	+35 40.0	+35 39.4	+35 37.6	+35 38.5	+35 37.9	+35 36.1	+35 36.9	+35 36.3	+35 34.6
- 80 45.0	+35 43.6	+35 43.1	+35 41.3	+35 42.1	+35 41.5	+35 39.8	+35 40.6	+35 40.0	+35 38.3
- 80 37.5	+35 47.3	+35 46.7	+35 44.9	+35 45.8	+35 45.2	+35 43.4	+35 44.2	+35 43.7	+35 42.0
- 80 30.0	+35 50.9	+35 50.3	+35 48.6	+35 49.4	+35 48.8	+35 47.1	+35 47.9	+35 47.3	+35 45.6
- 80 22.5	+35 54.5	+35 53.9	+35 52.2	+35 53.0	+35 52.4	+35 50.7	+35 51.5	+35 50.9	+35 49.2
- 80 15.0	+35 58.1	+35 57.5	+35 55.7	+35 56.6	+35 56.0	+35 54.3	+35 55.1	+35 54.5	+35 52.8
- 80 07.5	+36 01.6	+36 01.0	+35 59.3	+36 00.1	+35 59.6	+35 57.9	+35 58.7	+35 58.1	+35 56.4
- 80 00.0	+36 05.2	+36 04.6	+36 02.8	+36 03.7	+36 03.1	+36 01.4	+36 02.2	+36 01.7	+36 00.0
- 79 52.5	+36 08.7	+36 08.1	+36 06.4	+36 07.2	+36 06.7	+36 05.0	+36 05.8	+36 05.2	+36 03.5
- 79 45.0	+36 12.2	+36 11.6	+36 09.9	+36 10.7	+36 10.2	+36 08.5	+36 09.3	+36 08.7	+36 07.1
- 79 37.5	+36 15.7	+36 15.1	+36 13.4	+36 14.2	+36 13.7	+36 12.0	+36 12.8	+36 12.2	+36 10.6
- 79 30.0	+36 19.1	+36 18.5	+36 16.8	+36 17.7	+36 17.1	+36 15.4	+36 16.3	+36 15.7	+36 14.1
- 79 22.5	+36 22.6	+36 22.0	+36 20.3	+36 21.1	+36 20.6	+36 18.9	+36 19.7	+36 19.2	+36 17.5
- 79 15.0	+36 26.0	+36 25.4	+36 23.7	+36 24.6	+36 24.0	+36 22.3	+36 23.2	+36 22.6	+36 21.0
- 79 07.5	+36 29.4	+36 28.8	+36 27.1	+36 28.0	+36 27.4	+36 25.8	+36 26.6	+36 26.0	+36 24.4
- 79 00.0	+36 32.8	+36 32.2	+36 30.5	+36 31.4	+36 30.8	+36 29.2	+36 30.0	+36 29.4	+36 27.8
- 78 52.5	+36 36.1	+36 35.6	+36 33.9	+36 34.7	+36 34.2	+36 32.5	+36 33.3	+36 32.8	+36 31.2
- 78 45.0	+36 39.5	+36 38.9	+36 37.2	+36 38.1	+36 37.5	+36 35.9	+36 36.7	+36 36.2	+36 34.6
- 78 37.5	+36 42.8	+36 42.2	+36 40.6	+36 41.4	+36 40.9	+36 39.2	+36 40.0	+36 39.5	+36 37.9
- 78 30.0	+36 46.1	+36 45.5	+36 43.9	+36 44.7	+36 44.2	+36 42.5	+36 43.4	+36 42.8	+36 41.2
- 78 22.5	+36 49.4	+36 48.8	+36 47.2	+36 48.0	+36 47.5	+36 45.8	+36 46.7	+36 46.1	+36 44.5
- 78 15.0	+36 52.6	+36 52.1	+36 50.4	+36 51.3	+36 50.7	+36 49.1	+36 49.9	+36 49.4	+36 47.8
- 78 07.5	+36 55.9	+36 55.3	+36 53.7	+36 54.5	+36 54.0	+36 52.4	+36 53.2	+36 52.7	+36 51.1

PATH OF THE ANNULAR PHASE OVER LAND AT FLYING ALTITUDES

Longitude	Latitude of Northern Limit at			Latitude of Central Line at			Latitude of Southern Limit at		
	Sea Level	10,000 Ft.	40,000 Ft.	Sea Level	10,000 Ft.	40,000 Ft.	Sea Level	10,000 Ft.	40,000 Ft.
° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
-78 00.0	+36 59.1	+36 58.6	+36 56.9	+36 57.8	+36 57.2	+36 55.6	+36 56.4	+36 55.9	+36 54.3
-77 52.5	+37 02.3	+37 01.8	+37 00.1	+37 01.0	+37 00.5	+36 58.8	+36 59.7	+36 59.1	+36 57.6
-77 45.0	+37 05.5	+37 05.0	+37 03.3	+37 04.2	+37 03.6	+37 02.0	+37 02.9	+37 02.3	+37 00.8
-77 37.5	+37 08.7	+37 08.1	+37 06.5	+37 07.4	+37 06.8	+37 05.2	+37 06.0	+37 05.5	+37 04.0
-77 30.0	+37 11.8	+37 11.3	+37 09.7	+37 10.5	+37 10.0	+37 08.4	+37 09.2	+37 08.7	+37 07.1
-77 22.5	+37 15.0	+37 14.4	+37 12.8	+37 13.7	+37 13.1	+37 11.5	+37 12.3	+37 11.8	+37 10.3
-77 15.0	+37 18.1	+37 17.5	+37 15.9	+37 16.8	+37 16.2	+37 14.7	+37 15.5	+37 15.0	+37 13.4
-77 07.5	+37 21.2	+37 20.6	+37 19.0	+37 19.9	+37 19.3	+37 17.8	+37 18.6	+37 18.1	+37 16.5
-77 00.0	+37 24.2	+37 23.7	+37 22.1	+37 22.9	+37 22.4	+37 20.9	+37 21.7	+37 21.1	+37 19.6
-76 52.5	+37 27.3	+37 26.8	+37 25.2	+37 26.0	+37 25.5	+37 23.9	+37 24.7	+37 24.2	+37 22.7
-76 45.0	+37 30.3	+37 29.8	+37 28.2	+37 29.0	+37 28.5	+37 27.0	+37 27.8	+37 27.3	+37 25.7
-76 37.5	+37 33.3	+37 32.8	+37 31.2	+37 32.1	+37 31.6	+37 30.0	+37 30.8	+37 30.3	+37 28.8
-76 30.0	+37 36.3	+37 35.8	+37 34.2	+37 35.1	+37 34.6	+37 33.0	+37 33.8	+37 33.3	+37 31.8
-76 22.5	+37 39.3	+37 38.8	+37 37.2	+37 38.1	+37 37.5	+37 36.0	+37 36.8	+37 36.3	+37 34.8
-76 15.0	+37 42.3	+37 41.8	+37 40.2	+37 41.0	+37 40.5	+37 39.0	+37 39.8	+37 39.3	+37 37.7
-76 07.5	+37 45.2	+37 44.7	+37 43.1	+37 44.0	+37 43.5	+37 41.9	+37 42.7	+37 42.2	+37 40.7
-76 00.0	+37 48.2	+37 47.6	+37 46.1	+37 46.9	+37 46.4	+37 44.8	+37 45.6	+37 45.1	+37 43.6
-75 52.5	+37 51.1	+37 50.5	+37 49.0	+37 49.8	+37 49.3	+37 47.8	+37 48.5	+37 48.0	+37 46.5
-75 45.0	+37 53.9	+37 53.4	+37 51.9	+37 52.7	+37 52.2	+37 50.7	+37 51.4	+37 50.9	+37 49.4
-75 37.5	+37 56.8	+37 56.3	+37 54.7	+37 55.6	+37 55.1	+37 53.5	+37 54.3	+37 53.8	+37 52.3
-75 30.0	+37 59.7	+37 59.1	+37 57.6	+37 58.4	+37 57.9	+37 56.4	+37 57.2	+37 56.7	+37 55.2
-75 22.5	+38 02.5	+38 02.0	+38 00.4	+38 01.2	+38 00.7	+37 59.2	+38 00.0	+37 59.5	+37 58.0
-75 15.0	+38 05.3	+38 04.8	+38 03.3	+38 04.1	+38 03.6	+38 02.1	+38 02.8	+38 02.3	+38 00.8
-75 07.5	+38 08.1	+38 07.6	+38 06.1	+38 06.9	+38 06.4	+38 04.9	+38 05.6	+38 05.1	+38 03.6
-75 00.0	+38 10.9	+38 10.4	+38 08.8	+38 09.6	+38 09.1	+38 07.6	+38 08.4	+38 07.9	+38 06.4
-74 30.0	+38 21.8	+38 21.3	+38 19.8	+38 20.6	+38 20.1	+38 18.6	+38 19.3	+38 18.8	+38 17.4
-74 00.0	+38 32.4	+38 31.9	+38 30.4	+38 31.2	+38 30.7	+38 29.2	+38 30.0	+38 29.5	+38 28.0
-73 30.0	+38 42.8	+38 42.3	+38 40.8	+38 41.5	+38 41.0	+38 39.6	+38 40.3	+38 39.8	+38 38.4
-73 00.0	+38 52.8	+38 52.3	+38 50.8	+38 51.6	+38 51.1	+38 49.7	+38 50.3	+38 49.9	+38 48.5
-72 30.0	+39 02.6	+39 02.1	+39 00.6	+39 01.3	+39 00.9	+38 59.4	+39 00.1	+38 59.6	+38 58.2
-72 00.0	+39 12.1	+39 11.6	+39 10.1	+39 10.8	+39 10.3	+39 08.9	+39 09.6	+39 09.1	+39 07.7
-71 30.0	+39 21.3	+39 20.8	+39 19.4	+39 20.0	+39 19.5	+39 18.1	+39 18.8	+39 18.3	+39 16.9
-71 00.0	+39 30.2	+39 29.7	+39 28.3	+39 28.9	+39 28.5	+39 27.1	+39 27.7	+39 27.2	+39 25.8
-70 30.0	+39 38.9	+39 38.4	+39 37.0	+39 37.6	+39 37.1	+39 35.7	+39 36.3	+39 35.9	+39 34.5
-70 00.0	+39 47.3	+39 46.8	+39 45.4	+39 46.0	+39 45.5	+39 44.1	+39 44.7	+39 44.2	+39 42.9
-69 30.0	+39 55.4	+39 54.9	+39 53.5	+39 54.1	+39 53.6	+39 52.2	+39 52.8	+39 52.3	+39 51.0
-69 00.0	+40 03.2	+40 02.8	+40 01.4	+40 01.9	+40 01.5	+40 00.1	+40 00.6	+40 00.1	+39 58.8
-68 30.0	+40 10.8	+40 10.4	+40 09.0	+40 09.5	+40 09.0	+40 07.7	+40 08.1	+40 07.7	+40 06.4
-68 00.0	+40 18.2	+40 17.7	+40 16.4	+40 16.8	+40 16.4	+40 15.0	+40 15.4	+40 15.0	+40 13.7
-67 30.0	+40 25.3	+40 24.8	+40 23.4	+40 23.9	+40 23.4	+40 22.1	+40 22.5	+40 22.0	+40 20.7
-67 00.0	+40 32.1	+40 31.7	+40 30.3	+40 30.7	+40 30.2	+40 28.9	+40 29.2	+40 28.8	+40 27.5
-66 30.0	+40 38.7	+40 38.2	+40 36.9	+40 37.2	+40 36.8	+40 35.5	+40 35.8	+40 35.3	+40 34.0
-66 00.0	+40 45.0	+40 44.6	+40 43.2	+40 43.5	+40 43.1	+40 41.8	+40 42.0	+40 41.6	+40 40.3
-65 30.0	+40 51.1	+40 50.7	+40 49.3	+40 49.6	+40 49.2	+40 47.8	+40 48.1	+40 47.6	+40 46.3
-65 00.0	+40 57.0	+40 56.5	+40 55.2	+40 55.4	+40 55.0	+40 53.6	+40 53.9	+40 53.4	+40 52.1
-32 00.0	+40 08.1	+40 07.5	+40 05.6	+40 01.0	+40 00.4	+39 58.5	+39 53.9	+39 53.3	+39 51.5
-31 30.0	+40 01.9	+40 01.3	+39 59.4	+39 54.7	+39 54.1	+39 52.2	+39 47.5	+39 46.8	+39 44.9
-31 00.0	+39 55.6	+39 54.9	+39 53.0	+39 48.2	+39 47.6	+39 45.6	+39 40.8	+39 40.2	+39 38.3
-30 30.0	+39 49.1	+39 48.4	+39 46.5	+39 41.6	+39 40.9	+39 39.0	+39 34.0	+39 33.4	+39 31.5
-30 00.0	+39 42.4	+39 41.8	+39 39.8	+39 34.8	+39 34.1	+39 32.2	+39 27.1	+39 26.5	+39 24.6
-29 30.0	+39 35.7	+39 35.0	+39 33.0	+39 27.9	+39 27.2	+39 25.3	+39 20.1	+39 19.4	+39 17.5
-29 00.0	+39 28.8	+39 28.1	+39 26.1	+39 20.8	+39 20.2	+39 18.2	+39 12.9	+39 12.3	+39 10.3
-28 30.0	+39 21.7	+39 21.1	+39 19.1	+39 13.7	+39 13.0	+39 11.0	+39 05.6	+39 04.9	+39 03.0
-28 00.0	+39 14.6	+39 13.9	+39 11.9	+39 06.4	+39 05.7	+39 03.7	+38 58.1	+38 57.5	+38 55.5
-27 30.0	+39 07.3	+39 06.6	+39 04.6	+38 58.9	+38 58.3	+38 56.2	+38 50.6	+38 49.9	+38 47.9
-27 00.0	+38 59.9	+38 59.2	+38 57.1	+38 51.4	+38 50.7	+38 48.7	+38 42.9	+38 42.2	+38 40.2
-9 00.0	+33 20.4	+33 19.6	+33 17.1	+33 06.0	+33 05.1	+33 02.7	+32 51.4	+32 50.6	+32 48.2
-8 30.0	+33 09.3	+33 08.5	+33 06.0	+32 54.7	+32 53.9	+32 51.4	+32 40.0	+32 39.2	+32 36.7
-8 00.0	+32 58.2	+32 57.4	+32 54.9	+32 43.4	+32 42.6	+32 40.1	+32 28.5	+32 27.7	+32 25.2
-7 30.0	+32 47.0	+32 46.2	+32 43.7	+32 32.0	+32 31.2	+32 28.7	+32 17.0	+32 16.1	+32 13.7
-7 00.0	+32 35.7	+32 34.9	+32 32.4	+32 20.6	+32 19.7	+32 17.2	+32 05.3	+32 04.5	+32 02.0

LOCAL CIRCUMSTANCES FOR POINTS ON CENTRAL LINE

Central Line			First Contact			Second Contact		
U.T.	Latitude	Longitude	U.T.	P	V	U.T.	P	V
h m	° ′	° ′	h m s	°	°	h m s	°	°
15 00	+ 6 16.8	-125 12.8	.. ..	...	...	14 59 32.9	244	332
15 02	+ 8 00.6	-121 59.3	14 00 59.4	245	327	15 01 34.3	244	331
15 04	+ 9 25.3	-119 31.2	14 01 40.9	245	326	15 03 35.5	243	330
15 06	+10 39.1	-117 28.1	14 02 31.4	244	326	15 05 36.6	243	330
15 08	+11 45.8	-115 41.4	14 03 27.9	244	325	15 07 37.5	242	329
15 10	+12 47.2	-114 06.3	14 04 28.7	244	324	15 09 38.4	242	328
15 15	+15 04.4	-110 43.1	14 07 13.8	243	323	15 14 40.4	242	327
15 20	+17 05.7	-107 52.5	14 10 11.9	242	322	15 19 42.2	241	326
15 25	+18 55.7	-105 22.9	14 13 18.9	242	320	15 24 43.8	241	324
15 30	+20 37.2	-103 07.9	14 16 32.6	242	319	15 29 45.3	241	323
15 35	+22 12.0	-101 03.4	14 19 51.9	242	318	15 34 46.7	241	321
15 40	+23 41.1	- 99 06.6	14 23 15.8	242	317	15 39 47.9	241	320
15 45	+25 05.3	- 97 15.6	14 26 43.8	241	316	15 44 49.1	241	318
15 50	+26 25.2	- 95 28.9	14 30 15.7	241	314	15 49 50.2	241	316
15 55	+27 41.3	- 93 45.2	14 33 51.1	241	313	15 54 51.2	241	314
16 00	+28 53.8	- 92 03.6	14 37 30.1	242	312	15 59 52.2	241	311
16 05	+30 03.0	- 90 23.4	14 41 12.6	242	311	16 04 53.0	242	308
16 10	+31 09.1	- 88 43.7	14 44 58.6	242	309	16 09 53.8	242	305
16 15	+32 12.2	- 87 04.1	14 48 48.2	242	308	16 14 54.4	242	301
16 20	+33 12.4	- 85 24.0	14 52 41.6	242	306	16 19 55.0	243	296
16 25	+34 09.8	- 83 42.9	14 56 39.0	243	304	16 24 55.5	243	291
16 30	+35 04.3	- 82 00.3	15 00 40.6	243	303	16 29 55.9	244	284
16 35	+35 56.1	- 80 15.9	15 04 46.8	243	300	16 34 56.3	245	277
16 40	+36 45.0	- 78 29.3	15 08 57.7	244	298	16 39 56.5	245	269
16 45	+37 31.0	- 76 40.0	15 13 13.8	244	295	16 44 56.6	246	260
16 50	+38 14.1	- 74 47.8	15 17 35.6	245	292	16 49 56.7	247	251
16 55	+38 54.1	- 72 52.2	15 22 03.4	245	288	16 54 56.6	248	244
17 00	+39 30.9	- 70 52.9	15 26 37.8	246	284	16 59 56.5	248	236
17 05	+40 04.5	- 68 49.6	15 31 19.3	247	279	17 04 56.2	249	230
17 10	+40 34.6	- 66 41.9	15 36 08.4	248	274	17 09 55.9	250	225
17 15	+41 01.0	- 64 29.4	15 41 05.9	248	267	17 14 55.5	251	221
17 20	+41 23.6	- 62 11.7	15 46 12.3	249	260	17 19 55.0	252	217
17 25	+41 42.0	- 59 48.5	15 51 28.4	250	253	17 24 54.3	253	214
17 30	+41 56.0	- 57 19.2	15 56 54.8	251	245	17 29 53.6	254	212
17 35	+42 05.1	- 54 43.2	16 02 32.3	252	238	17 34 52.8	255	210
17 40	+42 09.0	- 52 00.1	16 08 21.7	253	231	17 39 51.9	256	209
17 45	+42 07.1	- 49 08.8	16 14 23.7	254	225	17 44 50.9	256	208
17 50	+41 58.9	- 46 08.6	16 20 39.2	255	220	17 49 49.8	257	207
17 55	+41 43.4	- 42 57.9	16 27 09.2	256	215	17 54 48.6	258	206
18 00	+41 19.7	- 39 34.9	16 33 54.7	257	212	17 59 47.3	259	206
18 05	+40 46.2	- 35 56.8	16 40 57.0	258	209	18 04 45.9	260	205
18 10	+40 00.9	- 31 59.5	16 48 18.1	259	206	18 09 44.4	261	205
18 15	+39 00.4	- 27 36.0	16 56 01.0	260	204	18 14 42.7	262	205
18 20	+37 38.6	- 22 33.2	17 04 11.8	262	203	18 19 40.7	263	205
18 22	+36 57.5	- 20 15.4	17 07 38.4	262	202	18 21 39.8	263	205
18 24	+36 09.6	- 17 43.7	17 11 13.0	262	202	18 23 38.9	263	205
18 26	+35 12.2	- 14 52.0	17 14 58.5	263	201	18 25 37.9	264	205
18 28	+34 00.7	- 11 28.8	17 19 00.2	263	201	18 27 36.7	264	205
18 30	+32 22.1	- 7 04.2	17 23 32.3	264	201	18 29 35.2	265	205
18 32	+28 21.9	+ 2 57.9	17 30 45.5	265	200	18 31 32.1	265	205

LOCAL CIRCUMSTANCES FOR POINTS ON CENTRAL LINE

	Maximum Eclipse		Sun's		Third Contact			Fourth Contact				
U.T.	Obscuration	Magnitude	Alt.	Az.	U.T.	P	V	U.T.	P	V	Duration	Path Width
h m	%		°	°	h m s	°	°	h m s	°	°	m s	km
15 00	97.2	0.993	12	69	15 00 27.0	64	152	16 07 00.6	63	157	0 54.0	57
15 02	97.4	0.993	16	69	15 02 25.6	64	151	16 11 12.7	62	156	0 51.2	52
15 04	97.6	0.994	19	70	15 04 24.4	63	151	16 15 01.7	62	156	0 48.8	49
15 06	97.7	0.994	22	71	15 06 23.4	63	150	16 18 37.7	61	155	0 46.7	46
15 08	97.9	0.995	25	71	15 08 22.4	62	149	16 22 04.9	61	155	0 44.9	43
15 10	98.0	0.995	27	72	15 10 21.5	62	149	16 25 25.6	61	154	0 43.0	41
15 15	98.2	0.996	32	73	15 15 19.5	62	147	16 33 26.9	60	153	0 39.1	35
15 20	98.4	0.996	36	75	15 20 17.7	61	146	16 41 06.7	60	152	0 35.5	31
15 25	98.6	0.997	40	77	15 25 16.1	61	144	16 48 30.2	60	150	0 32.3	27
15 30	98.8	0.997	44	79	15 30 14.7	61	143	16 55 40.0	60	148	0 29.3	24
15 35	98.9	0.997	47	81	15 35 13.3	61	141	17 02 37.6	60	145	0 26.6	21
15 40	99.0	0.998	50	84	15 40 12.0	61	140	17 09 23.7	60	142	0 24.0	19
15 45	99.1	0.998	53	86	15 45 10.8	61	138	17 15 58.8	61	137	0 21.7	16
15 50	99.2	0.998	56	89	15 50 09.7	61	136	17 22 23.2	61	130	0 19.5	14
15 55	99.3	0.998	58	93	15 55 08.7	61	134	17 28 37.1	62	120	0 17.4	13
16 00	99.4	0.999	61	97	16 00 07.8	61	131	17 34 40.4	62	106	0 15.6	11
16 05	99.5	0.999	63	101	16 05 07.0	62	128	17 40 33.4	63	89	0 13.9	10
16 10	99.5	0.999	65	106	16 10 06.2	62	125	17 46 16.1	63	72	0 12.4	8
16 15	99.6	0.999	67	112	16 15 05.5	62	121	17 51 48.5	64	57	0 11.1	7
16 20	99.6	0.999	69	118	16 20 05.0	63	116	17 57 10.8	65	46	0 09.9	7
16 25	99.7	0.999	71	125	16 25 04.5	63	111	18 02 23.3	66	38	0 08.9	6
16 30	99.7	0.999	72	134	16 30 04.1	64	104	18 07 26.0	66	33	0 08.1	5
16 35	99.7	0.999	73	143	16 35 03.7	65	97	18 12 19.3	67	30	0 07.4	5
16 40	99.8	0.999	74	153	16 40 03.5	65	88	18 17 03.5	68	27	0 07.0	4
16 45	99.8	0.999	74	164	16 45 03.4	66	80	18 21 38.9	69	26	0 06.7	4
16 50	99.8	0.999	74	175	16 50 03.3	67	71	18 26 05.7	70	25	0 06.6	4
16 55	99.8	0.999	73	185	16 55 03.4	68	63	18 30 24.4	70	24	0 06.7	4
17 00	99.8	0.999	72	194	17 00 03.5	68	56	18 34 35.3	71	24	0 07.0	4
17 05	99.7	0.999	71	203	17 05 03.8	69	50	18 38 38.8	72	23	0 07.5	5
17 10	99.7	0.999	69	211	17 10 04.1	70	45	18 42 35.3	73	23	0 08.1	5
17 15	99.7	0.999	67	218	17 15 04.5	71	41	18 46 25.0	74	23	0 09.0	6
17 20	99.6	0.999	65	224	17 20 05.1	72	37	18 50 08.4	75	24	0 10.1	6
17 25	99.6	0.999	63	230	17 25 05.7	73	34	18 53 45.7	75	24	0 11.3	7
17 30	99.5	0.999	61	235	17 30 06.4	74	32	18 57 17.1	76	24	0 12.7	8
17 35	99.5	0.999	58	240	17 35 07.2	75	30	19 00 42.9	77	25	0 14.3	10
17 40	99.4	0.998	55	245	17 40 08.1	76	29	19 04 03.2	78	25	0 16.1	11
17 45	99.3	0.998	53	249	17 45 09.1	76	28	19 07 18.0	79	25	0 18.1	13
17 50	99.2	0.998	50	253	17 50 10.2	77	27	19 10 27.4	79	26	0 20.3	15
17 55	99.1	0.998	47	258	17 55 11.4	78	26	19 13 31.0	80	26	0 22.7	17
18 00	99.0	0.997	43	262	18 00 12.7	79	26	19 16 28.6	81	27	0 25.3	19
18 05	98.8	0.997	40	266	18 05 14.1	80	25	19 19 19.3	81	27	0 28.1	22
18 10	98.7	0.997	36	270	18 10 15.7	81	25	19 22 01.8	82	28	0 31.2	25
18 15	98.4	0.996	31	274	18 15 17.4	82	25	19 24 33.7	83	28	0 34.7	29
18 20	98.2	0.995	26	278	18 20 19.3	83	25	19 26 50.7	83	29	0 38.5	34
18 22	98.1	0.995	24	280	18 22 20.2	83	25	19 27 39.3	84	29	0 40.3	37
18 24	98.0	0.995	21	282	18 24 21.1	83	25	19 28 22.8	84	29	0 42.2	39
18 26	97.8	0.994	18	284	18 26 22.2	84	25	19 28 59.0	84	30	0 44.3	42
18 28	97.6	0.994	15	286	18 28 23.4	84	25	19 29 23.9	84	30	0 46.7	46
18 30	97.4	0.993	11	289	18 30 24.9	85	25	.. ..	...	...	0 49.6	51
18 32	96.8	0.992	1	295	18 32 28.0	85	25	.. ..	...	...	0 55.9	63

LOCAL CIRCUMSTANCES FOR GEOGRAPHIC LOCATIONS

	Position		First Contact			Second Contact		
	Latitude	Longitude	U.T.	P	V	U.T.	P	V
	° ′	° ′	h m s	°	°	h m s	°	°
Alabama								
Alexander City	+32 56.4	- 85 57.0	14 51 31.2	242	307			
Andalusia	+31 18.6	- 86 28.8	14 47 45.7	244	311			
Anniston	+33 40.8	- 85 51.6	14 53 05.0	241	305			
Auburn	+32 36.6	- 85 27.0	14 51 28.5	243	308			
Bay Minette	+30 53.4	- 87 46.8	14 45 29.1	243	311			
Birmingham	+33 31.8	- 86 48.6	14 51 42.7	241	304			
Citronelle	+31 07.2	- 88 14.4	14 45 25.7	242	310			
Dothan	+31 13.2	- 85 24.0	14 48 54.2	245	312			
Florence	+34 49.2	- 87 40.2	14 53 25.9	238	300			
Gadsden	+34 00.6	- 86 00.6	14 53 34.2	241	304			
Greenville	+31 49.8	- 86 37.8	14 48 34.7	243	309			
Grove Hill	+31 42.0	- 87 46.2	14 47 03.2	242	309			
Huntsville	+34 43.8	- 86 35.4	14 54 23.0	239	301			
Jackson	+31 31.8	- 87 52.8	14 46 36.3	242	309			
Jasper	+33 50.4	- 87 16.8	14 51 49.6	240	303			
Mobile	+30 40.8	- 88 06.6	14 44 43.6	243	311			
Monroeville	+31 30.6	- 87 20.4	14 47 09.5	243	309			
Montgomery	+32 21.6	- 86 18.0	14 49 59.0	243	308			
Ozark	+31 26.4	- 85 39.0	14 49 00.3	244	311			
Roanoke	+33 09.0	- 85 21.6	14 52 37.9	242	306			
Selma	+32 25.2	- 87 01.8	14 49 16.2	242	307			
Sylacauga	+33 10.2	- 86 15.0	14 51 37.5	242	306			
Talladega	+33 25.8	- 86 06.0	14 52 18.7	241	305			
Thomasville	+31 55.2	- 87 44.4	14 47 30.8	242	308			
Troy	+31 48.6	- 85 56.4	14 49 21.1	243	310			
Tuscaloosa	+33 12.0	- 87 32.4	14 50 15.6	240	305			
Arizona								
Flagstaff	+35 12.6	-111 37.2	14 44 29.8	219	280			
Phoenix	+33 30.0	-112 04.8	14 40 36.7	220	283			
Tucson	+32 13.2	-110 55.2	14 37 38.9	223	287			
Yuma	+32 42.0	-114 37.8	14 39 12.2	219	282			
Arkansas								
Fort Smith	+35 22.8	- 94 24.0	14 49 05.6	232	294			
Little Rock	+34 44.4	- 92 19.2	14 49 08.4	235	297			
Pine Bluff	+34 13.2	- 92 01.2	14 48 15.3	236	299			
California								
Fresno	+36 46.2	-119 46.8	14 50 11.0	211	269			
Los Angeles	+34 04.8	-118 22.2	14 43 18.7	215	276			
San Diego	+32 45.0	-117 08.4	14 39 54.6	217	280			
San Francisco	+37 45.6	-122 26.4	14 53 43.1	208	265			
Colorado								
Denver	+39 43.2	-104 58.8	14 55 25.5	219	275			
Grand Junction	+39 04.2	-108 33.0	14 53 36.8	217	274			
Pueblo	+38 17.4	-104 38.4	14 51 58.1	221	279			
Connecticut								
Bridgeport	+41 11.4	- 73 11.4	15 25 32.0	242	280			
Hartford	+41 45.6	- 72 41.4	15 27 22.0	242	278			
New Haven	+41 18.6	- 72 55.8	15 26 10.2	242	280			
Delaware								
Bethany Beach	+38 32.4	- 75 04.2	15 17 41.1	244	291			
Dover	+39 09.6	- 75 31.8	15 18 04.1	243	289			
Laurel	+38 33.0	- 75 34.2	15 16 53.1	244	291			
Lewes	+38 46.8	- 75 08.4	15 18 00.2	244	290			
Rehoboth Beach	+38 43.2	- 75 04.8	15 17 59.5	244	290			
Wilmington	+39 45.0	- 75 33.0	15 19 07.8	242	287			

LOCAL CIRCUMSTANCES FOR GEOGRAPHIC LOCATIONS

Maximum Eclipse U.T. h	m	s	Obscuration %	Magnitude	Sun's Alt. °	Sun's Az. °	Third Contact U.T. h	m	s	P °	V °	Fourth Contact U.T. h	m	s	P °	V °	Duration m	s	Path Width km
16	18	27.7	97.6	0.982	69	116						17	55	30.4	65	49			
16	14	27.6	95.8	0.967	68	110						17	52	01.3	62	51			
16	19	57.8	97.5	0.981	69	118						17	56	37.1	66	50			
16	18	49.8	97.3	0.979	69	116						17	56	19.1	64	45			
16	11	14.0	96.6	0.974	66	107						17	48	12.7	62	63			
16	17	54.3	95.6	0.966	68	116						17	54	07.3	66	56			
16	10	49.4	98.0	0.985	66	107						17	47	25.2	63	67			
16	16	23.4	93.4	0.949	69	112						17	54	33.6	61	42			
16	18	39.0	90.6	0.926	67	118						17	53	29.7	69	64			
16	20	16.0	96.1	0.970	68	115						17	56	37.9	66	52			
16	15	08.2	97.8	0.983	68	111						17	52	22.9	63	53			
16	12	46.1	97.2	0.979	67	109						17	49	24.0	64	63			
16	20	27.5	92.8	0.944	68	120						17	56	00.8	68	57			
16	12	14.9	97.2	0.978	66	108						17	48	53.5	63	64			
16	17	35.8	94.0	0.954	67	116						17	53	20.6	67	60			
16	10	13.9	97.1	0.977	66	106						17	47	05.3	62	66			
16	13	12.6	97.0	0.977	67	109						17	50	11.4	63	59			
16	16	44.3	97.3	0.980	68	113						17	53	54.3	64	51			
16	16	18.3	94.5	0.957	69	112						17	54	15.3	62	44			
16	19	58.6	99.5	0.997	69	118						17	57	12.7	65	46			
16	15	28.3	98.8	0.991	67	112						17	52	11.5	64	57			
16	18	18.3	97.1	0.978	68	116						17	55	03.3	65	52			
16	19	03.5	97.3	0.979	68	117						17	55	44.2	66	51			
16	13	14.0	97.4	0.980	67	110						17	49	46.7	64	62			
16	16	25.3	96.0	0.969	69	113						17	54	03.2	63	47			
16	15	57.5	95.6	0.966	67	113						17	51	56.3	66	61			
15	48	43.1	46.9	0.570	41	91						17	00	25.4	88	148			
15	45	12.7	49.8	0.595	40	89						16	57	38.3	86	149			
15	43	48.2	54.5	0.636	41	88						16	58	21.5	84	148			
15	41	52.3	47.4	0.574	38	86						16	51	59.8	88	152			
16	08	38.5	76.6	0.816	59	108						17	38	01.0	74	103			
16	10	38.8	82.3	0.861	62	109						17	42	13.5	72	93			
16	10	09.7	84.3	0.877	62	108						17	42	20.3	71	92			
15	45	56.5	31.9	0.434	34	87						16	47	07.4	98	158			
15	41	57.0	38.9	0.499	35	85						16	46	54.6	93	156			
15	40	19.5	43.4	0.539	35	85						16	47	37.4	90	155			
15	46	18.0	26.9	0.385	32	86						16	43	34.1	102	160			
16	03	19.7	47.7	0.577	49	103						17	18	31.5	89	133			
15	58	33.9	43.6	0.541	46	98						17	10	28.2	91	141			
16	01	02.4	51.4	0.609	49	101						17	17	55.8	86	133			
16	56	39.7	91.2	0.931	71	184						18	29	53.0	74	33			
16	58	14.1	89.7	0.920	70	187						18	30	50.1	75	34			
16	57	19.0	91.0	0.930	70	186						18	30	24.1	75	33			
16	49	46.3	98.4	0.987	73	174						18	25	35.8	70	26			
16	49	31.7	95.6	0.966	73	172						18	24	46.1	71	29			
16	48	42.1	97.1	0.977	73	171						18	24	30.3	70	27			
16	49	54.5	97.5	0.981	73	174						18	25	30.9	71	27			
16	49	58.0	97.8	0.983	73	174						18	25	37.7	70	27			
16	50	11.2	93.6	0.950	72	173						18	24	51.4	72	32			

LOCAL CIRCUMSTANCES FOR GEOGRAPHIC LOCATIONS

	Position		First Contact			Second Contact		
	Latitude	Longitude	U.T.	P	V	U.T.	P	V
District of Columbia	° ′	° ′	h m s	°	°	h m s	°	°
Washington	+38 52.8	- 77 01.2	15 15 13.3	242	291			
Florida								
Gainesville	+29 39.6	- 82 19.8	14 50 22.7	249	319			
Jacksonville	+30 19.2	- 81 39.0	14 52 32.4	249	317			
Miami	+25 46.8	- 80 13.2	14 47 57.7	256	333			
Orlando	+28 32.4	- 81 22.8	14 50 02.5	252	323			
Tallahassee	+30 26.4	- 84 17.4	14 48 55.4	247	315			
Tampa	+27 57.6	- 82 28.2	14 47 22.2	251	324			
Georgia								
Albany	+31 34.8	- 84 09.6	14 51 10.1	245	312			
Athens	+33 55.2	- 83 20.4	14 56 39.9	243	305			
Atlanta	+33 45.6	- 84 24.6	14 54 59.1	243	305	16 22 50.6	271	321
Augusta	+33 28.2	- 81 59.4	14 57 39.3	245	308			
Brunswick	+31 09.6	- 81 29.4	14 54 13.7	248	315			
College Park	+33 39.0	- 84 27.6	14 54 42.5	243	306			
Columbus	+32 28.8	- 84 57.0	14 51 50.4	244	309			
Commerce	+34 12.0	- 83 27.0	14 57 03.8	243	305			
Decatur	+33 46.2	- 84 18.0	14 55 08.5	243	305			
East Point	+33 41.4	- 84 27.0	14 54 47.9	243	305			
Forest Park	+33 37.2	- 84 21.6	14 54 46.5	243	306			
Gainesville	+34 18.6	- 83 49.8	14 56 47.4	242	304			
Griffin	+33 15.0	- 84 16.2	14 54 10.4	243	307			
La Grange	+33 02.4	- 85 01.8	14 52 49.1	243	307			
Lavonia	+34 26.4	- 83 06.6	14 57 58.4	243	304			
Macon	+32 49.8	- 83 39.6	14 54 09.9	244	308			
Marietta	+33 57.0	- 84 32.4	14 55 11.7	242	305			
Rome	+34 15.6	- 85 10.8	14 55 02.1	241	303			
Savannah	+32 03.0	- 81 05.4	14 56 24.0	248	312			
Smyrna	+33 52.8	- 84 31.2	14 55 05.0	242	305			
Valdosta	+30 50.4	- 83 17.4	14 51 01.1	247	315			
Winder	+34 00.0	- 83 43.2	14 56 19.6	243	305			
Hawaii								
Honolulu	+21 18.6	-157 50.4	.. ..	...	...			
Idaho								
Boise	+43 36.6	-116 13.2	15 06 29.2	206	258			
Coeur D'Alene	+47 40.8	-116 46.2	15 17 50.5	202	248			
Pocatello	+42 52.8	-112 27.0	15 03 40.8	210	263			
Illinois								
Champaign	+40 06.6	- 88 15.0	15 04 26.4	232	285			
Chicago	+41 51.0	- 87 40.8	15 08 56.8	230	280			
Peoria	+40 42.6	- 89 36.6	15 04 41.3	230	283			
Rockford	+42 16.2	- 89 04.2	15 08 47.0	229	279			
Springfield	+39 48.0	- 89 39.0	15 02 32.9	231	285			
Indiana								
Bloomington	+39 12.6	- 86 34.8	15 03 57.8	234	288			
Evansville	+37 58.8	- 87 33.0	15 00 18.4	235	291			
Fort Wayne	+41 04.2	- 85 09.0	15 09 32.2	233	283			
Indianapolis	+39 47.4	- 86 08.4	15 05 41.1	234	287			
Iowa								
Ames	+42 02.4	- 93 36.6	15 05 07.0	226	277			
Davenport	+41 32.4	- 90 35.4	15 05 53.7	229	280			
Des Moines	+41 36.0	- 93 37.8	15 04 02.0	226	278			
Iowa City	+41 40.2	- 91 31.8	15 05 32.3	228	279			
Sioux City	+42 30.0	- 96 24.0	15 04 48.4	223	275			
Kansas								
Dodge City	+37 45.6	-100 01.2	14 51 49.3	225	284			
Lawrence	+38 57.6	- 95 15.0	14 56 47.3	228	284			
Topeka	+39 02.4	- 95 41.4	14 56 44.4	227	284			
Wichita	+37 40.8	- 97 19.8	14 52 43.3	227	286			

LOCAL CIRCUMSTANCES FOR GEOGRAPHIC LOCATIONS

Maximum Eclipse					Sun's		Third Contact					Fourth Contact							Path
U.T.			Obscuration	Magnitude	Alt.	Az.	U.T.			P	V	U.T.			P	V	Duration		Width
h	m	s	%		°	°	h	m	s	°	°	h	m	s	°	°	m	s	km
16	46	02.0	94.5	0.957	72	165						18	21	25.2	71	31			
16	19	53.0	82.8	0.865	73	113						17	59	50.2	57	14			
16	22	34.2	83.7	0.872	74	118						18	02	33.2	58	14			
16	17	27.7	66.3	0.732	76	103						17	57	58.9	49	343			
16	19	55.8	77.4	0.822	74	112						18	00	21.2	55	4			
16	17	10.8	88.9	0.913	71	112						17	56	09.8	59	31			
16	16	25.3	77.6	0.823	73	107						17	56	35.7	54	7			
16	19	31.9	92.3	0.940	71	116						17	58	08.0	61	33			
16	25	20.2	98.2	0.987	71	126						18	03	02.3	65	36			
16	22	55.1	99.7	0.999	70	122	16	22	59.6	36	85	18	00	15.1	65	41	0	09.0	6
16	27	21.2	94.3	0.955	73	128						18	05	50.0	64	28			
16	24	25.2	86.1	0.891	74	122						18	04	10.0	59	16			
16	22	37.6	97.3	0.979	70	122						18	00	00.2	65	41			
16	19	34.5	96.6	0.974	70	117						17	57	22.9	63	41			
16	25	35.7	98.8	0.991	71	126						18	03	04.4	65	37			
16	23	09.2	97.5	0.981	70	122						18	00	31.8	65	41			
16	22	43.0	97.3	0.979	70	122						18	00	04.4	65	41			
16	22	46.3	97.3	0.979	70	122						18	00	12.8	65	41			
16	25	01.4	99.2	0.994	71	125						18	02	16.0	66	40			
16	22	17.9	96.8	0.975	70	121						18	00	00.1	64	39			
16	20	25.4	98.4	0.988	70	118						17	57	53.2	64	43			
16	26	41.5	97.6	0.982	71	128						18	04	09.0	66	36			
16	22	47.2	95.0	0.961	71	121						18	00	59.5	63	34			
16	22	59.7	97.3	0.979	70	122						18	00	08.8	66	42			
16	22	17.5	96.1	0.970	69	122						17	58	55.8	66	47			
16	26	51.1	88.3	0.908	74	126						18	06	20.5	61	18			
16	22	54.7	97.3	0.979	70	122						18	00	07.1	65	42			
16	19	59.1	88.4	0.909	72	115						17	59	14.5	60	25			
16	24	42.5	99.1	0.993	71	125						18	02	12.0	65	38			
..	..	....	.....	.....	...	...						16	05	21.7	110	179			
16	00	40.1	25.0	0.366	40	97						16	59	15.4	104	152			
16	07	42.5	18.5	0.297	40	101						17	00	54.1	110	152			
16	02	11.2	30.9	0.424	43	100						17	05	53.4	100	146			
16	26	42.9	73.8	0.793	65	130						17	56	27.2	78	74			
16	30	26.6	69.6	0.759	64	135						17	58	35.6	80	75			
16	25	29.2	69.9	0.762	63	128						17	53	40.2	79	81			
16	28	52.3	66.3	0.732	63	132						17	55	38.4	82	81			
16	23	54.4	72.4	0.782	63	126						17	53	02.2	78	80			
16	28	05.5	79.2	0.836	66	131						17	59	46.9	75	65			
16	24	21.6	81.3	0.853	66	126						17	56	40.2	74	67			
16	33	31.0	75.7	0.809	66	140						18	03	59.2	78	63			
16	29	47.7	78.1	0.828	66	134						18	01	08.0	76	64			
16	21	39.7	60.0	0.681	59	123						17	45	20.0	84	98			
16	25	19.0	66.0	0.730	62	127						17	51	52.9	81	86			
16	20	53.1	61.1	0.690	59	122						17	45	02.4	83	98			
16	24	05.8	64.2	0.715	61	126						17	49	49.3	82	90			
16	18	36.2	54.5	0.635	57	119						17	39	21.9	86	108			
16	05	24.0	60.4	0.684	54	105						17	27	33.4	82	122			
16	13	56.5	65.4	0.726	58	114						17	39	29.2	80	104			
16	13	28.0	64.5	0.718	58	113						17	38	32.6	81	106			
16	08	44.3	65.2	0.724	56	108						17	33	34.5	80	113			

LOCAL CIRCUMSTANCES FOR GEOGRAPHIC LOCATIONS

	Position		First Contact			Second Contact		
	Latitude	Longitude	U.T.	P	V	U.T.	P	V
	° ′	° ′	h m s	°	°	h m s	°	°
Kentucky								
Corbin	+36 56.4	- 84 06.0	15 01 45.9	239	296			
Frankfort	+38 12.0	- 84 51.6	15 03 33.1	237	292			
Lexington	+38 03.6	- 84 29.4	15 03 40.0	237	292			
Louisville	+38 13.2	- 85 45.0	15 02 38.3	236	292			
Louisiana								
Baton Rouge	+30 27.0	- 91 08.4	14 41 17.4	241	309			
Bogalusa	+30 46.8	- 89 51.6	14 43 07.5	241	309			
Covington	+30 28.8	- 90 06.0	14 42 18.7	241	310			
Hammond	+30 30.6	- 90 27.6	14 42 01.8	241	309			
Lafayette	+30 13.2	- 92 01.2	14 40 04.6	240	309			
Lake Charles	+30 12.6	- 93 12.0	14 39 06.1	239	308			
Laplace	+30 04.2	- 90 29.4	14 41 09.2	242	311			
Metairie	+30 00.0	- 90 10.8	14 41 18.8	242	311			
Monroe	+32 30.6	- 92 06.0	14 44 36.3	237	303			
Morgan City	+29 42.6	- 91 12.0	14 39 48.5	241	311			
New Orleans	+29 58.2	- 90 04.8	14 41 21.2	242	311			
Shreveport	+32 28.2	- 93 46.2	14 43 15.6	236	302			
Slidell	+30 16.2	- 89 46.8	14 42 13.2	242	311			
Thibodaux	+29 47.4	- 90 49.2	14 40 18.5	242	311	16 03 40.1	209	277
Maine								
Augusta	+44 19.2	- 69 46.2	15 36 35.4	240	266			
Portland	+43 40.2	- 70 16.8	15 34 38.6	241	269			
Maryland								
Annapolis	+38 58.2	- 76 30.0	15 16 11.4	243	290			
Baltimore	+39 18.6	- 76 37.2	15 16 38.9	242	289			
Bethesda	+38 59.4	- 77 06.6	15 15 17.7	242	290			
Hagerstown	+39 38.4	- 77 43.2	15 15 38.7	241	288			
Ocean City	+38 23.4	- 75 04.8	15 17 23.9	244	292			
Pocomoke City	+38 04.2	- 75 33.6	15 16 01.9	245	293			
Salisbury	+38 21.6	- 75 36.0	15 16 29.5	244	292			
Snow Hill	+38 10.2	- 75 23.4	15 16 29.5	245	293			
Massachusetts								
Boston	+42 19.2	- 71 05.4	15 30 58.5	242	274			
Springfield	+42 06.6	- 72 33.0	15 28 13.3	241	277			
Worcester	+42 16.2	- 71 48.6	15 29 42.2	242	275			
Michigan								
Ann Arbor	+42 16.8	- 83 44.4	15 13 42.1	233	280			
Detroit	+42 22.8	- 83 05.4	15 14 37.0	233	280			
Flint	+43 01.8	- 83 41.4	15 15 26.4	232	278			
Grand Rapids	+42 57.6	- 85 39.6	15 13 20.6	231	278			
Lansing	+42 43.2	- 84 33.6	15 13 51.4	232	278			
Mount Pleasant	+43 36.0	- 84 46.2	15 15 39.9	231	276			
Minnesota								
Duluth	+46 47.4	- 92 06.6	15 17 50.2	222	265			
Hibbing	+47 25.2	- 92 55.2	15 19 00.3	220	263			
International Falls	+48 36.0	- 93 24.6	15 21 48.9	219	260			
Mankato	+44 09.6	- 94 00.0	15 10 08.7	223	272			
Minneapolis	+44 57.6	- 93 16.2	15 12 33.1	223	270			
Northfield	+44 27.6	- 93 09.6	15 11 21.5	223	271			
Mississippi								
Biloxi	+30 24.6	- 88 55.2	14 43 21.3	243	311			
Columbus Base	+33 38.4	- 88 27.0	14 50 12.8	239	303			
Corinth	+34 55.8	- 88 30.0	14 52 50.2	238	299			
Hattiesburg	+31 19.2	- 89 18.6	14 44 42.9	241	308			
Jackson	+32 19.2	- 90 12.0	14 45 51.2	239	305			
Lucedale	+30 55.2	- 88 35.4	14 44 40.4	242	310			
McComb	+31 15.0	- 90 27.6	14 43 28.6	240	308			
Picayune	+30 31.8	- 89 40.8	14 42 49.0	242	310	16 07 01.6	240	305
Wiggins	+30 51.6	- 89 07.8	14 44 00.1	242	310	16 08 38.8	279	343

LOCAL CIRCUMSTANCES FOR GEOGRAPHIC LOCATIONS

Maximum Eclipse U.T. h m s	Obscuration %	Magnitude	Sun's Alt. °	Sun's Az. °	Third Contact U.T. h m s	Third Contact P °	Third Contact V °	Fourth Contact U.T. h m s	Fourth Contact P °	Fourth Contact V °	Duration m s	Path Width km
16 28 55.0	90.2	0.924	69	132				18 04 01.7	70	48		
16 29 32.4	85.1	0.883	68	134				18 03 08.7	73	55		
16 30 00.0	86.1	0.891	69	134				18 03 55.1	72	53		
16 27 57.0	83.5	0.871	67	131				18 01 04.5	73	59		
16 04 29.8	96.8	0.976	62	101				17 39 21.6	64	94		
16 07 18.2	96.9	0.977	64	103				17 42 57.6	64	83		
16 06 19.1	97.6	0.982	64	102				17 41 55.5	63	85		
16 05 45.5	97.7	0.983	63	102				17 41 05.8	64	88		
16 02 36.6	95.3	0.964	61	100				17 36 53.4	64	101		
16 00 42.6	93.4	0.949	60	98				17 34 03.3	65	108		
16 04 52.0	99.3	0.996	63	101				17 40 20.7	63	90		
16 05 15.8	98.9	0.993	63	101				17 40 59.3	63	88		
16 06 50.0	89.0	0.914	62	104				17 39 59.5	68	95		
16 02 58.8	97.1	0.978	62	99				17 38 03.7	63	97		
16 05 22.7	98.6	0.990	64	101				17 41 11.0	62	87		
16 04 08.1	85.9	0.890	60	102				17 35 57.0	69	105		
16 06 28.3	97.5	0.981	64	102				17 42 22.8	63	83		
16 03 46.3	99.5	0.998	63	100	16 03 52.5	94	162	17 39 06.4	63	94	0 12.4	10
17 06 04.0	83.4	0.870	67	198				18 35 33.5	80	39		
17 04 37.9	85.3	0.885	68	196				18 34 55.7	78	37		
16 47 14.4	94.7	0.958	73	167				18 22 35.8	71	31		
16 47 24.9	93.5	0.949	72	167				18 22 26.0	72	32		
16 45 59.1	94.0	0.953	72	165				18 21 15.5	71	32		
16 45 33.8	91.1	0.930	72	163				18 20 06.7	73	36		
16 49 34.1	98.7	0.990	73	173				18 25 31.6	70	26		
16 48 07.7	97.5	0.981	74	170				18 24 21.6	69	25		
16 48 24.1	97.3	0.979	73	171				18 24 22.6	70	27		
16 48 37.4	97.9	0.984	74	171				18 24 46.3	70	26		
17 01 59.3	89.4	0.917	69	193				18 33 51.6	76	34		
16 58 50.5	88.7	0.911	70	187				18 31 03.5	76	35		
17 00 29.0	88.9	0.913	69	190				18 32 28.7	76	34		
16 37 45.7	74.1	0.795	67	146				18 07 30.2	79	61		
16 39 02.6	74.7	0.800	67	149				18 08 57.1	79	59		
16 38 54.3	71.8	0.777	66	148				18 07 45.4	81	63		
16 35 27.9	69.3	0.756	65	142				18 03 26.0	81	69		
16 36 58.4	71.5	0.775	66	145				18 05 47.9	80	65		
16 37 52.2	68.6	0.751	65	146				18 05 29.7	82	68		
16 31 25.0	49.8	0.595	59	134				17 50 12.0	91	97		
16 31 16.8	47.2	0.572	58	134				17 48 34.6	92	100		
16 32 25.0	43.7	0.541	57	135				17 47 38.9	94	103		
16 24 39.2	53.9	0.630	58	126				17 45 27.5	88	101		
16 26 57.6	52.9	0.621	59	129				17 47 19.6	88	99		
16 26 18.4	54.3	0.633	59	128				17 47 24.2	87	98		
16 08 15.3	96.8	0.976	65	104				17 44 41.6	62	75		
16 15 07.3	92.8	0.944	66	113				17 50 15.5	67	68		
16 17 22.3	88.7	0.912	66	116				17 51 36.5	69	69		
16 09 17.2	97.7	0.982	65	105				17 45 05.6	64	77		
16 09 37.5	93.3	0.948	64	107				17 44 19.3	66	82		
16 09 48.8	98.7	0.990	65	106				17 46 16.1	63	71		
16 07 09.9	95.4	0.965	63	104				17 42 11.7	65	86		
16 07 08.5	99.5	0.999	64	103	16 07 15.4	64	129	17 43 01.3	63	82	0 13.8	9
16 08 44.1	99.5	0.998	65	105	16 08 49.3	24	88	17 44 51.6	63	76	0 10.4	9

ANNULAR SOLAR ECLIPSE OF 30 MAY 1984

LOCAL CIRCUMSTANCES FOR GEOGRAPHIC LOCATIONS

	Position		First Contact			Second Contact		
	Latitude	Longitude	U.T.	P	V	U.T.	P	V
	° ′	° ′	h m s	°	°	h m s	°	°
Missouri								
Cape Girardeau	+37 18.6	- 89 31.8	14 57 01.6	234	292			
Jefferson City	+38 34.2	- 92 10.8	14 57 47.9	231	287			
Kansas City	+39 03.0	- 94 33.0	14 57 23.7	228	285			
Springfield	+37 12.0	- 93 17.4	14 53 54.1	231	290			
St. Louis	+38 37.8	- 90 15.0	14 59 23.3	232	288			
Montana								
Billings	+45 46.8	-108 32.4	15 10 59.7	210	259			
Helena	+46 35.4	-112 01.8	15 13 35.4	207	255			
Missoula	+46 51.6	-114 00.0	15 14 44.7	205	252			
Nebraska								
Grand Island	+40 55.8	- 98 21.0	15 00 05.8	223	277			
Lincoln	+40 48.6	- 96 40.2	15 00 30.9	225	279			
Scottsbluff	+41 51.6	-103 39.6	15 00 59.0	218	271			
Nevada								
Carson City	+39 09.0	-119 46.8	14 56 05.1	208	264			
Las Vegas	+36 10.2	-115 10.2	14 47 21.0	215	275			
New Hampshire								
Manchester	+42 59.4	- 71 27.6	15 31 32.7	241	272			
New Jersey								
Atlantic City	+39 21.6	- 74 26.4	15 20 11.8	244	288			
Cape May	+38 56.4	- 74 54.6	15 18 40.1	244	290			
Newark	+40 44.4	- 74 11.4	15 23 06.5	242	283			
Princeton	+40 21.0	- 74 39.6	15 21 38.7	242	284			
Trenton	+40 13.2	- 74 45.6	15 21 14.8	242	285			
New Mexico								
Las Cruces	+32 20.4	-106 43.8	14 37 58.2	226	290			
Santa Fe	+35 40.2	-105 57.0	14 45 34.6	223	284			
New York								
Albany	+42 39.6	- 73 46.8	15 27 18.8	240	276			
Buffalo	+42 54.6	- 78 51.0	15 20 44.4	236	277			
Hampton Bays	+40 52.2	- 72 30.6	15 26 04.8	243	281			
Ithaca	+42 26.4	- 76 29.4	15 22 55.7	238	278			
Jamestown	+42 06.6	- 79 14.4	15 18 34.1	237	280			
New York	+40 43.8	- 73 55.2	15 23 31.3	242	283			
Poughkeepsie	+41 42.0	- 73 55.2	15 25 18.3	241	279			
Rochester	+43 09.6	- 77 36.6	15 22 51.8	236	276			
North Carolina								
Asheville	+35 35.4	- 82 33.6	15 00 56.9	242	301			
Burlington	+36 05.4	- 79 25.8	15 06 18.0	244	300			
Chapel Hill	+35 55.2	- 79 03.0	15 06 33.2	244	301			
Charlotte	+35 13.2	- 80 49.8	15 02 36.3	244	303			
Durham	+36 00.0	- 78 54.6	15 06 55.0	244	300			
Eden	+36 30.0	- 79 45.0	15 06 36.5	243	299			
Fayetteville	+35 03.6	- 78 54.0	15 05 11.9	246	304			
Gastonia	+35 15.6	- 81 10.8	15 02 11.0	243	302			
Goldsboro	+35 22.8	- 77 58.8	15 07 14.4	246	303			
Greensboro	+36 04.2	- 79 48.6	15 05 42.0	244	300			
Greenville	+35 36.0	- 77 22.2	15 08 37.6	246	302			
Hickory	+35 44.4	- 81 20.4	15 02 53.1	243	301			
High Point	+35 57.6	- 80 00.0	15 05 12.8	244	300			
Kannapolis	+35 30.0	- 80 37.2	15 03 26.4	244	302			
Raleigh	+35 47.4	- 78 39.0	15 06 55.6	245	301			
Reidsville	+36 21.6	- 79 40.2	15 06 27.5	243	299			
Rocky Mount	+35 56.4	- 77 48.0	15 08 32.5	245	301			
Shelby	+35 17.4	- 81 32.4	15 01 44.3	243	302	16 31 15.9	287	326
Statesville	+35 47.4	- 80 53.4	15 03 36.7	243	301			
Thomasville	+35 53.4	- 80 04.8	15 04 57.8	244	301			
Wilmington	+34 13.2	- 77 55.8	15 05 15.9	248	307			
Wilson	+35 43.8	- 77 54.6	15 07 59.0	246	302			
Winston—Salem	+36 06.0	- 80 15.6	15 05 06.2	243	300			

ANNULAR SOLAR ECLIPSE OF 30 MAY 1984

LOCAL CIRCUMSTANCES FOR GEOGRAPHIC LOCATIONS

Maximum Eclipse			Sun's		Third Contact			Fourth Contact				
U.T. h m s	Obscuration %	Magnitude	Alt. °	Az. °	U.T. h m s	P °	V °	U.T. h m s	P °	V °	Duration m s	Path Width km
16 19 49.8	79.9	0.842	64	120				17 51 27.0	74	77		
16 17 47.3	71.7	0.776	61	118				17 46 16.4	78	91		
16 15 06.2	66.4	0.733	59	115				17 41 10.2	80	101		
16 13 38.6	73.6	0.792	60	113				17 42 29.1	76	96		
16 20 56.5	74.8	0.801	63	122				17 50 49.5	76	82		
16 10 51.4	30.7	0.422	46	108				17 15 36.5	100	138		
16 09 17.5	25.1	0.367	43	105				17 09 13.1	105	145		
16 08 13.6	22.5	0.340	42	103				17 05 36.3	107	148		
16 13 17.5	55.4	0.642	55	113				17 34 00.0	85	115		
16 15 16.9	58.3	0.667	57	115				17 37 40.5	84	109		
16 08 40.4	45.1	0.554	50	107				17 23 05.4	91	129		
15 50 13.7	27.9	0.395	35	89				16 49 14.9	101	157		
15 47 46.8	39.5	0.504	38	89				16 54 42.7	93	152		
17 01 47.1	86.6	0.895	69	192				18 32 57.7	77	36		
16 52 05.4	95.8	0.967	72	178				18 27 09.6	71	28		
16 50 35.7	97.0	0.977	73	175				18 26 03.4	71	27		
16 54 07.8	91.7	0.935	71	180				18 27 50.2	74	33		
16 52 43.9	92.4	0.940	72	178				18 26 49.9	73	32		
16 52 22.7	92.7	0.943	72	177				18 26 36.5	73	32		
15 47 46.8	61.6	0.695	45	91				17 06 51.2	80	142		
15 54 46.7	55.2	0.641	47	96				17 12 25.6	84	138		
16 56 53.5	85.4	0.885	69	183				18 28 31.1	77	39		
16 47 25.5	78.6	0.831	68	164				18 18 06.5	79	49		
16 57 46.1	93.0	0.945	71	187				18 31 16.8	74	30		
16 51 21.6	83.1	0.867	69	172				18 23 02.7	77	43		
16 45 42.9	80.7	0.849	69	161				18 17 15.3	77	48		
16 54 40.8	92.1	0.938	71	181				18 28 23.7	74	32		
16 55 40.4	88.6	0.911	70	182				18 28 21.9	75	35		
16 50 01.9	79.3	0.837	68	169				18 20 40.7	79	47		
16 29 43.4	97.1	0.978	71	133				18 06 34.5	67	37		
16 37 00.6	97.4	0.980	74	147				18 14 24.7	67	28		
16 37 34.1	96.8	0.975	74	148				18 15 10.6	67	26		
16 32 41.2	97.0	0.977	73	139				18 10 23.2	66	29		
16 37 59.4	96.9	0.976	74	149				18 15 33.9	67	26		
16 36 57.1	97.3	0.979	73	147				18 13 57.4	68	30		
16 36 35.2	94.5	0.957	75	146				18 14 50.6	65	22		
16 32 01.0	97.4	0.980	73	137				18 09 35.1	66	31		
16 39 06.1	94.3	0.955	75	152				18 17 16.6	65	21		
16 36 10.3	98.1	0.986	73	145				18 13 30.2	67	29		
16 40 47.1	94.2	0.954	75	156				18 18 52.3	66	20		
16 32 27.3	97.1	0.978	72	138				18 09 37.1	67	33		
16 35 36.0	98.8	0.991	73	144				18 12 58.3	67	29		
16 33 34.5	97.7	0.982	73	140				18 11 07.8	66	29		
16 38 14.4	96.2	0.971	74	150				18 16 01.1	66	24		
16 36 54.5	97.5	0.981	73	147				18 14 02.7	68	29		
16 40 19.4	96.0	0.969	75	154				18 18 06.9	66	23		
16 31 19.0	99.7	0.999	72	136	16 31 22.2	21	59	18 08 45.1	66	32	0 06.3	5
16 33 28.0	97.7	0.982	73	140				18 10 43.7	67	31		
16 35 19.4	99.1	0.994	73	144				18 12 43.7	67	29		
16 37 27.9	90.3	0.924	76	148				18 16 24.3	63	16		
16 39 46.4	95.5	0.965	75	153				18 17 42.4	66	22		
16 35 16.1	99.1	0.993	73	144				18 12 27.9	67	30		

ANNULAR SOLAR ECLIPSE OF 30 MAY 1984

LOCAL CIRCUMSTANCES FOR GEOGRAPHIC LOCATIONS

	Position		First Contact			Second Contact		
	Latitude	Longitude	U.T.	P	V	U.T.	P	V
	° ′	° ′	h m s	°	°	h m s	°	°
North Dakota								
Bismarck	+46 48.6	-100 46.8	15 14 27.0	215	261			
Fargo	+46 52.2	- 96 47.4	15 15 49.2	218	263			
Minot	+48 14.4	-101 18.0	15 18 10.9	213	257			
Ohio								
Cincinnati	+39 08.4	- 84 30.6	15 05 57.5	236	289			
Cleveland	+41 28.8	- 81 39.6	15 14 15.5	235	282			
Columbus	+39 58.8	- 82 59.4	15 09 28.8	236	287			
Toledo	+41 40.2	- 83 34.2	15 12 31.4	234	282			
Youngstown	+41 05.4	- 80 39.0	15 14 38.9	237	284			
Oklahoma								
Oklahoma City	+35 28.8	- 97 31.8	14 47 34.3	230	291			
Tulsa	+36 08.4	- 95 56.4	14 49 52.9	230	291			
Oregon								
Eugene	+44 03.0	-123 06.0	15 10 28.4	200	251			
Pendleton	+45 40.2	-118 48.0	15 12 58.5	202	251			
Portland	+45 31.2	-122 39.0	15 14 18.3	199	248			
Salem	+44 55.8	-123 01.8	15 12 51.7	200	249			
Pennsylvania								
Erie	+42 07.2	- 80 04.8	15 17 32.0	236	280			
Harrisburg	+40 16.2	- 76 52.8	15 18 06.0	241	286			
Philadelphia	+40 00.0	- 75 09.0	15 20 13.4	242	286			
Pittsburgh	+40 26.4	- 79 58.2	15 14 09.4	238	286			
Scranton	+41 24.6	- 75 40.2	15 22 05.6	240	281			
Rhode Island								
Providence	+41 49.2	- 71 25.8	15 29 32.5	243	276			
South Carolina								
Anderson	+34 30.6	- 82 39.0	14 58 43.2	243	304			
Charleston	+32 48.6	- 79 57.6	14 59 29.8	248	311			
Clemson	+34 42.0	- 82 48.6	14 58 52.5	243	303			
Columbia	+34 00.6	- 81 00.0	15 00 05.1	245	306			
Florence	+34 11.4	- 79 46.8	15 02 14.9	246	306			
Gaffney	+35 04.2	- 81 39.0	15 01 09.7	243	303			
Greenville	+34 51.0	- 82 23.4	14 59 43.6	243	303	16 28 47.9	295	337
Greenwood	+34 11.4	- 82 09.0	14 58 47.2	244	305			
Liberty	+34 46.8	- 82 42.0	14 59 10.6	243	303			
Rock Hill	+34 55.8	- 81 01.2	15 01 46.9	244	303			
Seneca	+34 40.8	- 82 57.0	14 58 39.1	243	303			
Spartanburg	+34 56.4	- 81 55.8	15 00 31.5	243	303			
South Dakota								
Pierre	+44 22.2	-100 20.4	15 08 08.7	218	268			
Rapid City	+44 04.2	-103 13.8	15 06 44.7	216	267			
Sioux Falls	+43 32.4	- 96 42.6	15 07 16.9	222	272			
Tennessee								
Chattanooga	+35 02.4	- 85 16.8	14 56 29.2	240	301			
Knoxville	+35 58.8	- 83 56.4	14 59 59.2	240	299			
Memphis	+35 07.2	- 89 59.4	14 51 51.7	236	298			
Nashville	+36 09.6	- 86 46.2	14 57 10.0	238	297			
Texas								
Amarillo	+35 12.0	-101 51.0	14 45 17.5	226	288			
Austin	+30 17.4	- 97 43.8	14 36 19.9	235	303			
Beaumont	+30 04.8	- 94 07.2	14 38 09.3	238	307			
Brownsville	+25 54.6	- 97 29.4	14 28 03.4	240	313			
Corpus Christi	+27 45.0	- 97 24.6	14 31 30.7	238	309			
Dallas	+32 47.4	- 96 47.4	14 42 02.5	233	298			
El Paso	+31 47.4	-106 25.2	14 36 48.3	226	292			
Galveston	+29 18.0	- 94 48.6	14 36 08.1	239	308			
Houston	+29 45.0	- 95 23.4	14 36 37.6	238	307			
San Antonio	+29 25.8	- 98 30.0	14 34 12.6	235	304			

ANNULAR SOLAR ECLIPSE OF 30 MAY 1984

LOCAL CIRCUMSTANCES FOR GEOGRAPHIC LOCATIONS

Maximum Eclipse							Third Contact					Fourth Contact							
U.T. h	m	s	Obscuration %	Magnitude	Sun's Alt. °	Sun's Az. °	U.T. h	m	s	P °	V °	U.T. h	m	s	P °	V °	Duration m	s	Path Width km
16	20	36.7	38.5	0.495	52	119						17	32	00.1	96	121			
16	25	26.1	43.5	0.540	55	126						17	40	21.9	94	111			
16	22	26.5	34.9	0.461	52	121						17	31	25.3	99	123			
16	31	40.7	82.7	0.864	68	137						18	04	32.1	74	56			
16	40	22.4	79.5	0.839	68	152						18	11	54.1	77	52			
16	35	45.8	82.4	0.862	69	144						18	08	26.0	75	52			
16	37	11.2	76.2	0.812	67	146						18	07	43.6	78	59			
16	41	43.5	82.2	0.860	69	154						18	14	02.1	76	48			
16	04	23.2	70.6	0.768	56	104						17	30	50.4	76	116			
16	07	49.0	71.7	0.777	58	107						17	35	14.1	76	109			
15	57	16.9	17.0	0.280	34	92						16	47	18.8	111	161			
16	02	42.5	19.2	0.304	38	97						16	55	57.4	109	155			
16	00	11.2	15.6	0.264	35	94						16	49	03.2	113	161			
15	58	54.9	16.0	0.268	34	93						16	48	01.1	113	161			
16	44	09.2	79.6	0.839	69	158						18	15	27.2	78	50			
16	48	03.8	90.0	0.921	71	168						18	22	05.3	74	36			
16	51	18.9	93.0	0.946	72	175						18	25	45.2	73	32			
16	42	08.7	85.3	0.884	70	155						18	15	22.2	75	44			
16	51	50.2	87.6	0.903	70	174						18	24	46.2	75	38			
17	00	52.5	90.9	0.928	70	192						18	33	18.8	75	32			
16	27	44.7	97.3	0.979	72	130						18	05	20.1	66	34			
16	30	38.2	88.9	0.913	75	134						18	10	02.3	61	17			
16	27	44.3	97.3	0.979	71	130						18	05	08.3	66	36			
16	30	21.5	94.6	0.958	73	134						18	08	49.2	64	25			
16	33	17.4	93.1	0.946	74	139						18	11	56.8	64	22			
16	30	43.9	98.5	0.989	72	135						18	08	17.3	66	32			
16	28	50.7	99.7	0.999	72	132	16	28	53.5	12	54	18	06	18.0	66	34	0	05.5	5
16	28	14.2	96.5	0.973	72	130						18	06	13.1	65	31			
16	28	05.8	97.5	0.981	72	130						18	05	29.0	66	35			
16	31	49.2	96.8	0.975	73	137						18	09	40.2	66	29			
16	27	25.3	97.3	0.979	71	129						18	04	46.8	66	36			
16	29	56.3	99.3	0.995	72	134						18	07	29.6	66	33			
16	16	55.3	44.3	0.547	53	116						17	31	48.9	92	120			
16	13	07.2	41.0	0.517	51	112						17	25	30.1	94	127			
16	19	59.0	51.5	0.609	56	120						17	39	14.7	88	109			
16	23	27.6	94.0	0.954	69	124						17	59	30.3	68	49			
16	27	38.3	93.4	0.948	70	130						18	03	36.9	69	45			
16	15	09.1	85.5	0.886	64	114						17	48	13.5	71	79			
16	22	37.9	88.1	0.907	67	123						17	56	59.9	70	60			
15	58	24.0	63.5	0.710	51	99						17	20	45.9	80	129			
15	54	17.3	84.1	0.876	55	94						17	23	36.8	69	126			
15	59	02.7	91.9	0.938	59	97						17	31	40.6	66	113			
15	46	15.3	96.1	0.971	53	88						17	16	58.3	62	135			
15	49	52.1	91.8	0.936	54	90						17	20	19.8	65	131			
16	00	20.1	79.2	0.837	56	100						17	29	17.1	72	118			
15	47	03.6	63.5	0.710	46	90						17	06	47.4	79	142			
15	56	30.8	92.6	0.943	58	95						17	28	50.0	65	119			
15	56	31.6	90.3	0.924	57	95						17	28	11.3	66	120			
15	51	37.8	84.9	0.882	53	92						17	20	34.0	68	130			

LOCAL CIRCUMSTANCES FOR GEOGRAPHIC LOCATIONS

	Position		First Contact			Second Contact		
	Latitude	Longitude	U.T.	P	V	U.T.	P	V
	° ′	° ′	h m s	°	°	h m s	°	°
Utah								
Salt Lake City	+40 45.6	-111 52.2	14 58 06.0	213	268			
Vermont								
Burlington	+44 28.8	- 73 13.2	15 31 35.4	238	269			
Montpelier	+44 15.6	- 72 34.2	15 32 08.1	238	269			
Virginia								
Alexandria	+38 49.2	- 77 04.8	15 15 01.0	242	291			
Bristol	+36 36.6	- 82 10.8	15 03 28.4	241	298			
Charlottesville	+38 02.4	- 78 29.4	15 11 24.8	242	294			
Chase City	+36 48.0	- 78 27.6	15 09 06.0	244	298			
Danville	+36 35.4	- 79 24.0	15 07 17.6	243	298			
Hopewell	+37 17.4	- 77 18.0	15 11 48.5	244	296			
Lynchburg	+37 24.6	- 79 09.6	15 09 13.0	242	296			
Martinsville	+36 40.2	- 79 52.2	15 06 45.7	243	298			
Newport News	+37 03.0	- 76 28.8	15 12 41.1	245	297			
Norfolk	+36 54.0	- 76 16.2	15 12 45.6	245	297			
Petersburg	+37 13.2	- 77 24.0	15 11 31.3	244	296	16 42 56.6	239	257
Richmond	+37 32.4	- 77 27.6	15 12 01.4	244	295			
Roanoke	+37 16.8	- 79 57.6	15 07 49.0	242	296			
South Boston	+36 42.6	- 78 54.0	15 08 15.9	244	298			
Virginia Beach	+36 51.0	- 76 06.0	15 12 57.2	246	297			
Williamsburg	+37 16.8	- 76 42.6	15 12 43.8	245	296			
Winchester	+39 10.8	- 78 09.6	15 14 06.5	241	290			
Washington								
Seattle	+47 37.8	-122 19.8	15 20 06.4	197	244			
Spokane	+47 40.2	-117 24.6	15 18 02.3	201	248			
West Virginia								
Charleston	+38 21.0	- 81 37.8	15 07 42.7	239	292			
Huntington	+38 24.6	- 82 25.8	15 06 49.8	239	292			
Wheeling	+40 04.2	- 80 42.0	15 12 27.0	238	287			
Wisconsin								
Eau Claire	+44 48.6	- 91 30.0	15 13 13.4	224	271			
La Crosse	+43 48.6	- 91 13.8	15 10 55.8	226	274			
Madison	+43 05.4	- 89 23.4	15 10 29.3	228	276			
Milwaukee	+43 03.0	- 87 57.0	15 11 32.1	229	277			
Wyoming								
Casper	+42 50.4	-106 19.2	15 03 13.1	215	267			
Cheyenne	+41 08.4	-104 48.0	14 59 00.0	218	272			
Mexico								
Aguascalientes	+21 52.2	-102 17.4	14 18 50.0	241	317			
Colima	+19 15.0	-103 43.8	14 14 15.3	243	321			
Ciudad de Mexico (Mexico City)	+19 24.0	- 99 11.4	14 16 28.5	247	326			
Guanajuato	+21 01.2	-101 16.2	14 17 52.9	243	320			
Leon	+21 08.4	-101 40.2	14 17 54.2	242	320			
Autlan	+19 46.8	-104 22.8	14 14 51.5	242	320	15 27 09.1	199	282
Guadalajara	+20 40.2	-103 19.8	14 16 33.3	242	319			
Ocotlan	+20 21.0	-102 46.8	14 16 14.7	242	320			
San Juan de los Lagos	+21 13.8	-102 19.8	14 17 47.3	242	319	15 31 39.1	241	322
Monterrey	+25 43.2	-100 19.2	14 26 16.5	238	311			
San Luis Potosi	+22 09.0	-100 58.8	14 19 48.9	242	318	15 34 53.5	303	24
Ciudad Victoria	+23 43.8	- 99 09.0	14 23 19.1	241	317	15 39 53.3	198	277
Jimenez	+24 13.2	- 98 28.8	14 24 30.9	241	316	15 41 36.9	210	288
Veracruz	+19 13.2	- 96 07.2	14 18 15.1	250	330			

LOCAL CIRCUMSTANCES FOR GEOGRAPHIC LOCATIONS

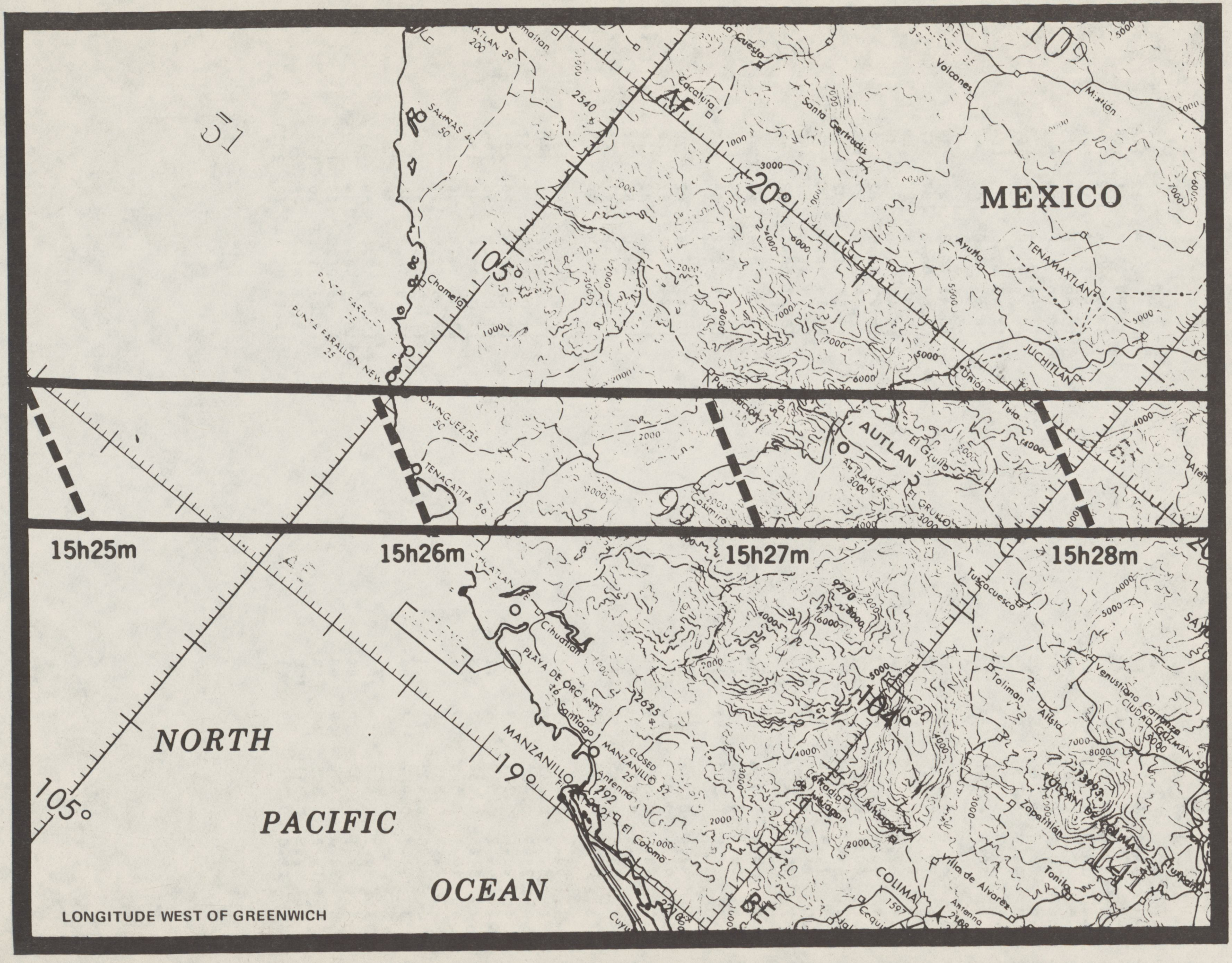
Maximum Eclipse					Third Contact			Fourth Contact				
U.T. h m s	Obscuration %	Magnitude	Sun's Alt. °	Sun's Az. °	U.T. h m s	P °	V °	U.T. h m s	P °	V °	Duration m s	Path Width km
15 58 45.6	35.5	0.467	43	97				17 05 18.8	96	146		
16 59 36.5	79.6	0.840	67	186				18 29 05.1	80	44		
17 00 39.4	81.1	0.851	67	188				18 30 24.3	80	42		
16 45 49.8	94.6	0.958	73	164				18 21 16.0	71	31		
16 32 08.1	94.2	0.955	71	138				18 08 19.2	69	39		
16 41 49.7	95.1	0.962	73	156				18 17 46.7	70	32		
16 40 08.1	99.6	0.997	74	153				18 17 09.4	68	28		
16 37 49.5	97.3	0.979	73	149				18 14 50.2	68	29		
16 43 19.3	97.7	0.982	74	160				18 20 06.1	68	26		
16 39 32.1	96.5	0.973	73	152				18 15 54.6	69	32		
16 36 57.4	96.9	0.976	73	147				18 13 47.7	68	31		
16 44 47.2	97.9	0.984	74	164				18 21 50.1	68	24		
16 45 03.0	97.2	0.978	74	165				18 22 13.9	68	23		
16 43 00.6	99.8	0.999	74	160	16 43 04.5	72	90	18 19 50.2	68	26	0 07.9	4
16 43 19.2	97.4	0.980	73	160				18 19 52.0	69	28		
16 37 40.9	95.3	0.964	72	148				18 13 59.0	69	34		
16 39 03.8	98.3	0.987	73	151				18 16 04.8	68	28		
16 45 21.6	96.7	0.974	75	165				18 22 35.4	67	22		
16 44 35.5	98.8	0.991	74	163				18 21 26.1	68	25		
16 44 03.7	92.0	0.937	72	160				18 18 59.6	72	35		
16 04 11.7	13.4	0.238	36	96				16 50 52.8	116	160		
16 07 15.4	17.9	0.290	39	101				16 59 43.2	111	153		
16 35 55.1	89.7	0.919	71	145				18 10 44.9	72	43		
16 34 27.2	88.3	0.908	70	142				18 08 56.0	72	46		
16 40 13.6	85.5	0.886	70	152				18 13 37.9	74	45		
16 29 13.0	55.8	0.645	60	132				17 51 07.1	87	93		
16 28 01.8	58.8	0.671	61	131				17 51 24.5	85	91		
16 29 40.0	63.5	0.709	62	133				17 55 13.8	83	83		
16 31 51.9	65.7	0.728	63	137				17 58 24.4	82	78		
16 07 40.3	39.2	0.501	48	106				17 18 12.5	94	135		
16 06 07.9	44.9	0.552	49	105				17 20 06.3	91	132		
15 33 04.4	96.2	0.972	45	81				16 59 35.5	61	146		
15 27 02.5	95.6	0.967	42	78				16 51 59.6	59	149		
15 32 04.2	87.4	0.902	47	78				17 00 42.2	54	147		
15 32 38.3	95.5	0.966	46	80				16 59 57.4	59	146		
15 32 25.4	96.1	0.971	46	80				16 59 24.9	59	146		
15 27 20.7	98.7	0.994	42	78	15 27 32.2	103	185	16 51 49.7	60	149	0 23.1	26
15 29 53.4	98.6	0.992	43	79				16 55 23.5	60	148		
15 29 52.6	97.8	0.985	44	79				16 55 48.7	59	148		
15 31 53.4	98.8	0.997	45	80	15 32 07.6	60	142	16 58 19.3	60	147	0 28.4	23
15 42 20.5	91.1	0.931	50	86				17 10 30.4	65	140		
15 34 59.7	98.9	0.995	47	81	15 35 05.8	358	79	17 02 41.1	60	145	0 12.2	21
15 40 02.2	99.0	0.996	50	84	15 40 11.0	103	182	17 09 23.9	61	141	0 17.6	19
15 41 47.0	99.1	0.996	51	85	15 41 57.0	92	170	17 11 43.8	61	140	0 20.1	18
15 35 32.3	80.2	0.845	51	79				17 06 19.7	51	146		

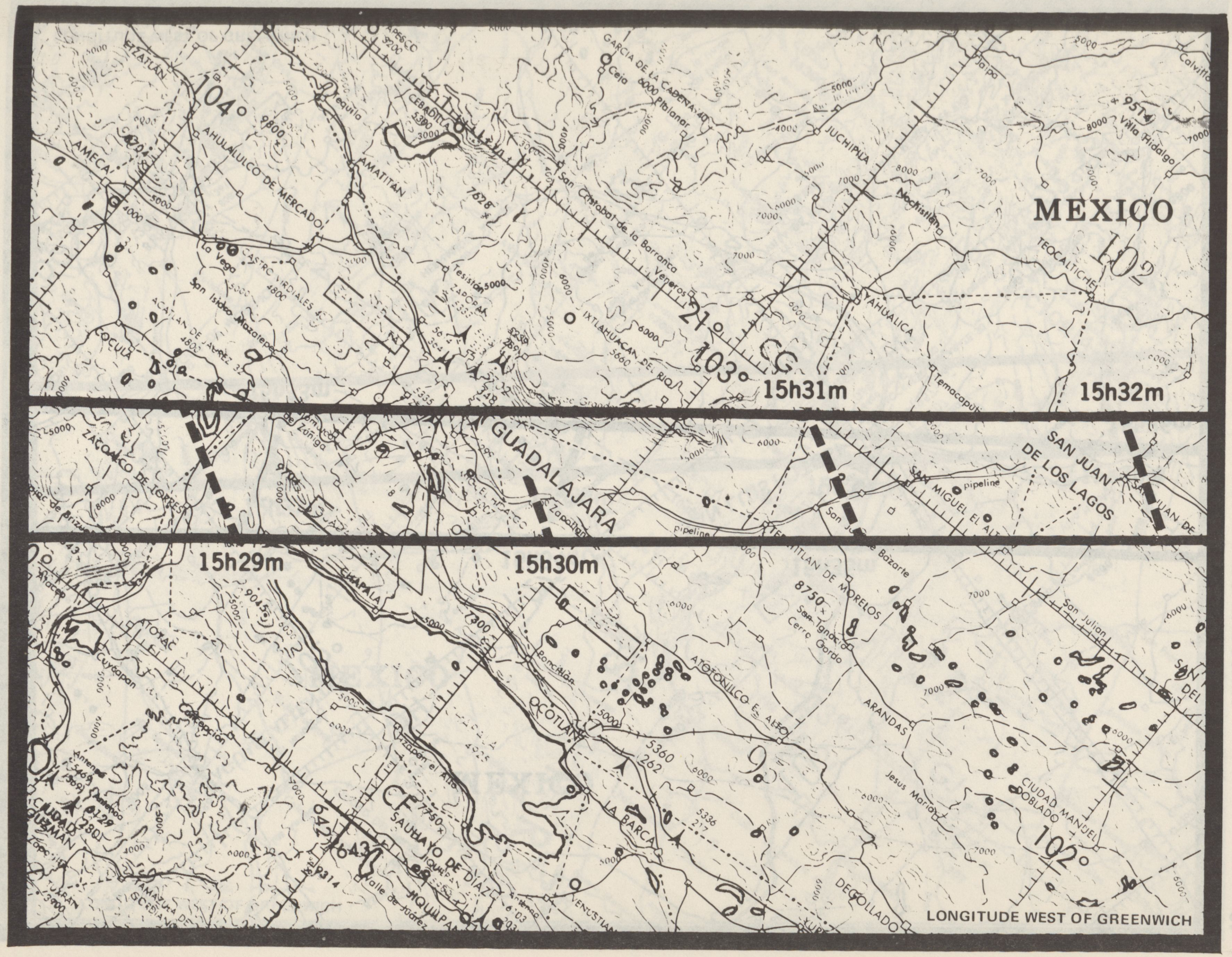
LOCAL CIRCUMSTANCES FOR GEOGRAPHIC LOCATIONS

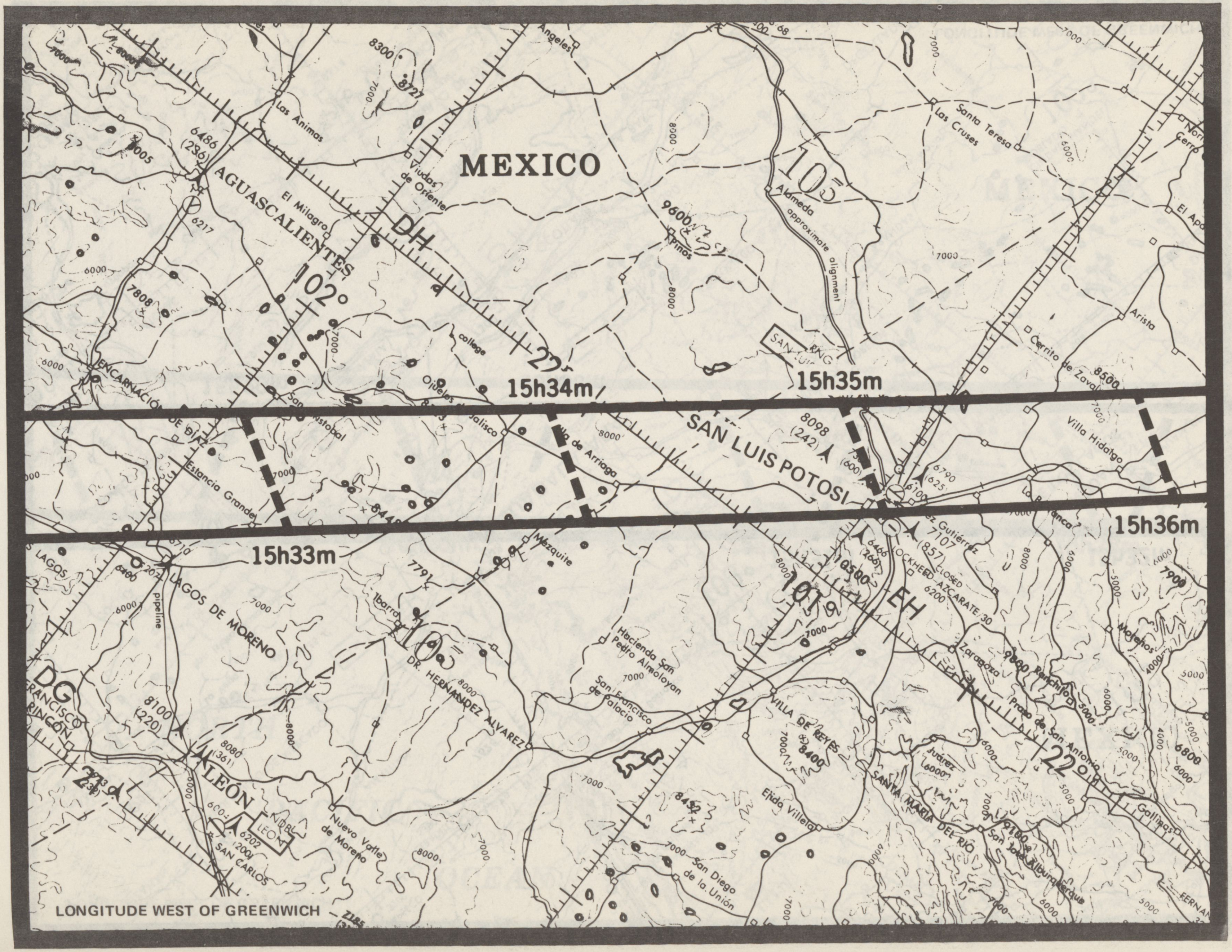
	Position		First Contact			Second Contact		
	Latitude	Longitude	U.T.	P	V	U.T.	P	V
	° ′	° ′	h m s	°	°	h m s	°	°
Canada								
Calgary	+51 03.0	-114 03.6	15 26 38.7	200	243			
Edmonton	+53 33.0	-113 29.4	15 33 49.6	198	237			
Lethbridge	+49 41.4	-112 49.2	15 22 25.4	203	247			
Penticton	+49 19.2	-119 37.2	15 23 39.2	198	242			
Prince Rupert	+54 19.2	-130 19.2	15 46 43.4	181	221			
Vancouver	+49 16.8	-123 07.8	15 25 20.0	195	240			
Brandon	+49 51.0	- 99 57.0	15 22 50.6	213	254			
The Pas	+53 49.8	-101 15.0	15 33 42.2	207	243			
Winnipeg	+49 54.0	- 97 08.4	15 23 45.1	215	255			
Moncton	+46 05.4	- 64 47.4	15 47 38.3	241	253			
Saint John	+45 16.2	- 66 04.8	15 44 13.5	241	257			
St. Johns	+47 34.2	- 52 43.8	16 10 23.7	244	228			
Halifax	+44 38.4	- 63 34.8	15 47 39.2	243	254			
Sydney	+46 08.4	- 60 10.8	15 55 40.8	243	244			
Ottawa	+45 25.8	- 75 42.6	15 30 01.1	235	268			
Sault Ste. Marie	+46 31.8	- 84 19.8	15 22 55.1	227	267			
Thunder Bay	+48 25.2	- 89 13.8	15 23 44.3	222	261			
Toronto	+43 40.2	- 79 24.0	15 21 40.1	234	275			
Charlottetown	+46 13.8	- 63 07.8	15 50 38.9	241	249			
Montreal	+45 30.6	- 73 34.8	15 33 03.6	236	266			
Quebec	+46 48.0	- 71 13.2	15 38 51.3	236	260			
Regina	+50 27.0	-104 36.6	15 23 51.8	208	250			
Saskatoon	+52 07.8	-106 39.6	15 28 36.0	205	245			
Azores								
Angra do Heroismo	+38 39.0	- 27 13.8	16 56 52.0	261	204			
Madelena	+38 31.8	- 28 31.8	16 55 00.2	261	205			
Ponta do Norte	+39 43.2	- 31 05.4	16 50 00.1	260	206	18 11 02.3	318	262
Santa Cruz	+39 28.2	- 31 07.8	16 50 07.1	260	206			
Santa Cruz da Graciosa	+39 04.8	- 28 00.0	16 55 21.6	260	204	18 14 19.0	273	216
Vila da Praia da Vitoria	+38 43.8	- 27 04.2	16 57 02.1	261	204			
Other Countries								
Nassau, Bahamas	+25 04.8	- 77 19.8	14 52 50.5	260	338			
Belize, Belize	+17 31.2	- 88 10.2	14 24 39.8	259	345			
San Jose, Costa Rica	+ 9 57.0	- 84 04.8	14 27 15.4	276	13			
Santo Domingo, Dominican Rep.	+18 30.0	- 69 55.2	15 09 51.9	280	15			
San Salvador, El Salvador	+13 45.0	- 89 10.8	14 19 40.9	264	353			
Guatemala, Guatemala	+14 37.2	- 90 31.8	14 18 33.7	261	349			
Tegucigalpa, Honduras	+14 07.8	- 87 15.0	14 22 58.2	265	355			
Reykjavik, Iceland	+64 09.0	- 21 39.0	16 55 31.2	216	191			
Kingston, Jamaica	+18 00.0	- 76 45.0	14 48 10.0	272	3			
Casablanca, Morocco	+33 31.8	- 7 37.8	17 22 06.6	262	200			
El Jadida, Morocco	+33 15.0	- 8 30.0	17 21 49.9	263	201			
Sidi Bennour, Morocco	+32 30.0	- 8 25.2	17 22 36.5	265	201			
Managua, Nicaragua	+12 10.2	- 86 16.2	14 23 26.6	269	2			
Colon, Panama	+ 9 22.2	- 79 54.0	14 38 27.4	283	24			
Arecibo, Puerto Rico	+18 28.2	- 66 45.0	15 22 04.6	284	25			
San Juan, Puerto Rico	+18 30.0	- 66 10.2	15 24 25.9	285	26			

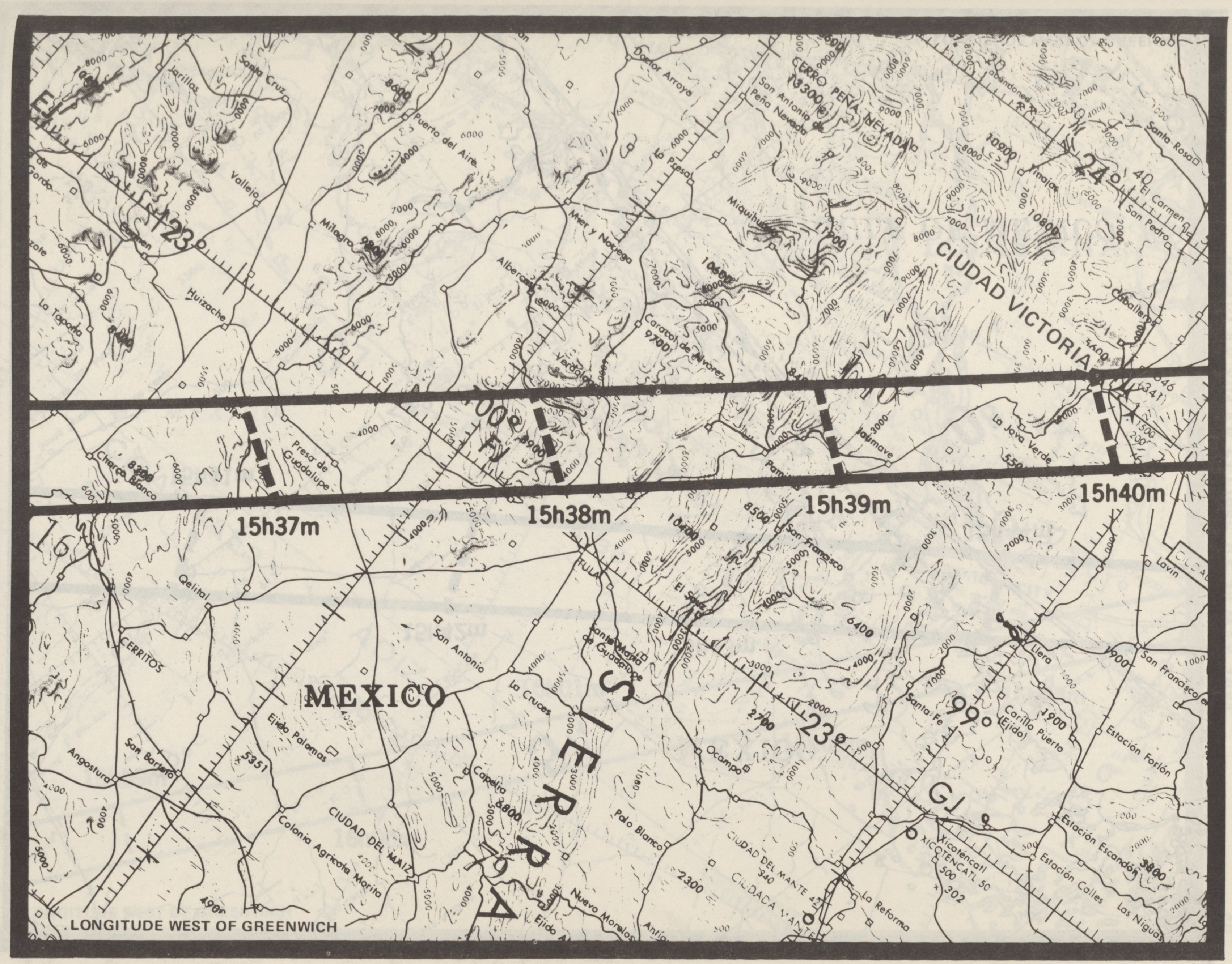
LOCAL CIRCUMSTANCES FOR GEOGRAPHIC LOCATIONS

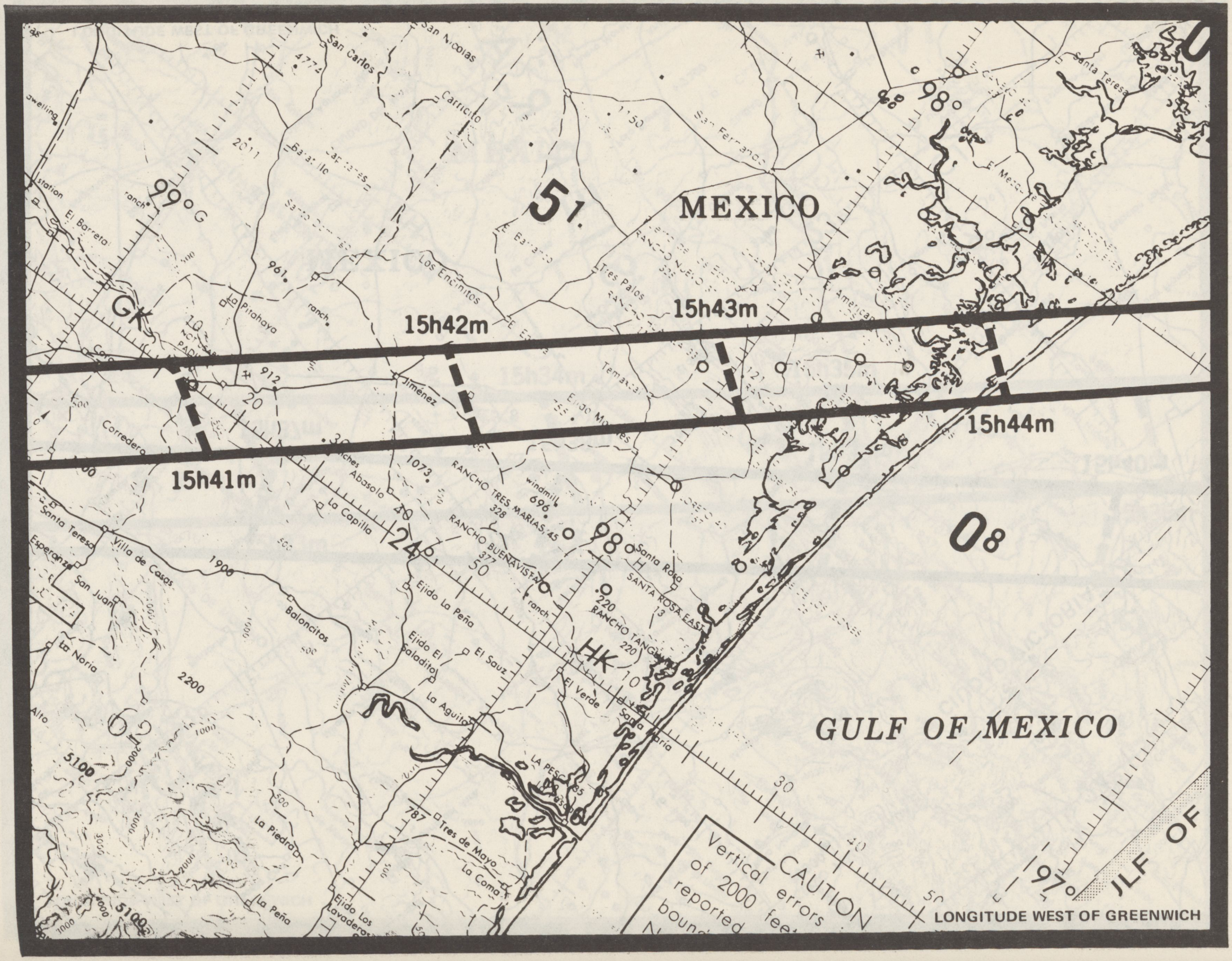
			Maximum Eclipse				Third Contact					Fourth Contact							
U.T.			Obscuration	Magnitude	Sun's Alt.	Sun's Az.	U.T.			P	V	U.T.			P	V	Duration		Path Width
h	m	s	%		°	°	h	m	s	°	°	h	m	s	°	°	m	s	km
16	15	41.2	16.6	0.275	42	108						17	07	34.8	113	148			
16	20	28.5	13.9	0.244	42	112						17	09	27.8	116	148			
16	14	13.0	19.6	0.309	43	108						17	09	19.4	110	146			
16	08	49.9	13.8	0.243	38	100						16	56	36.3	115	156			
16	12	38.6	2.7	0.080	31	96						16	39	11.0	135	173			
16	06	45.6	10.9	0.207	35	97						16	50	21.4	119	161			
16	26	33.6	33.2	0.446	52	125						17	34	31.4	100	120			
16	31	27.0	24.3	0.359	50	129						17	32	13.5	107	126			
16	29	49.2	36.3	0.475	54	130						17	40	09.6	99	114			
17	16	14.8	80.6	0.848	63	212						18	42	46.0	83	40			
17	13	35.1	82.8	0.865	64	209						18	41	20.5	81	39			
17	36	34.7	79.0	0.835	54	236						18	57	06.6	87	41			
17	18	05.9	86.7	0.895	63	216						18	45	50.8	80	35			
17	24	32.4	82.7	0.864	60	223						18	49	34.6	83	38			
16	55	52.4	73.8	0.793	66	177						18	23	56.9	82	51			
16	42	31.6	60.4	0.684	63	152						18	06	25.6	87	74			
16	37	46.2	49.2	0.590	59	143						17	56	11.1	92	91			
16	47	19.5	75.4	0.806	67	163						18	16	55.6	80	53			
17	19	17.0	81.0	0.851	62	216						18	45	11.8	83	40			
16	59	48.1	75.7	0.809	66	185						18	27	58.0	82	48			
17	04	59.6	73.4	0.790	65	192						18	31	30.4	84	49			
16	22	43.4	26.9	0.385	49	119						17	25	25.4	104	131			
16	23	36.7	22.0	0.335	47	119						17	21	51.2	108	135			
18	15	40.7	97.4	0.982	31	275						19	25	02.4	82	28			
18	14	44.5	96.6	0.975	32	274						19	24	49.8	82	26			
18	11	11.0	98.6	0.994	35	271	18	11	19.9	25	328	19	22	42.4	82	28	0	17.5	26
18	11	24.4	96.5	0.975	35	271						19	22	58.0	82	27			
18	14	35.9	98.5	0.995	32	274	18	14	52.8	71	14	19	24	22.9	83	28	0	33.7	29
18	15	43.1	97.5	0.983	31	275						19	24	59.5	83	28			
16	23	22.9	58.7	0.670	80	106						18	03	45.2	46	332			
15	44	34.1	57.7	0.662	60	76						17	18	18.2	41	160			
15	38	01.0	28.4	0.400	60	63						17	00	13.9	23	167			
16	33	46.3	26.6	0.381	87	354						18	03	31.6	29	293			
15	35	44.8	49.2	0.589	56	71						17	05	11.5	35	158			
15	35	09.7	54.6	0.636	55	73						17	05	20.4	38	156			
15	39	46.6	46.1	0.563	59	71						17	09	54.3	34	164			
17	46	45.8	21.4	0.329	30	258						18	35	55.9	121	93			
16	11	16.0	36.0	0.472	77	71						17	45	07.5	32	281			
18	28	54.3	94.7	0.962	12	289						19	28	40.5	86	32			
18	29	06.7	96.2	0.975	12	288						19	29	12.6	85	31			
18	29	48.8	97.1	0.982	12	289						19	29	48.1	84	29			
15	37	54.8	38.6	0.496	59	68						17	05	05.0	29	165			
15	46	01.4	19.3	0.305	65	58						17	03	24.2	16	181			
16	45	20.0	22.6	0.341	84	306						18	11	27.7	28	295			
16	47	36.1	22.0	0.335	83	301						18	13	04.0	28	295			

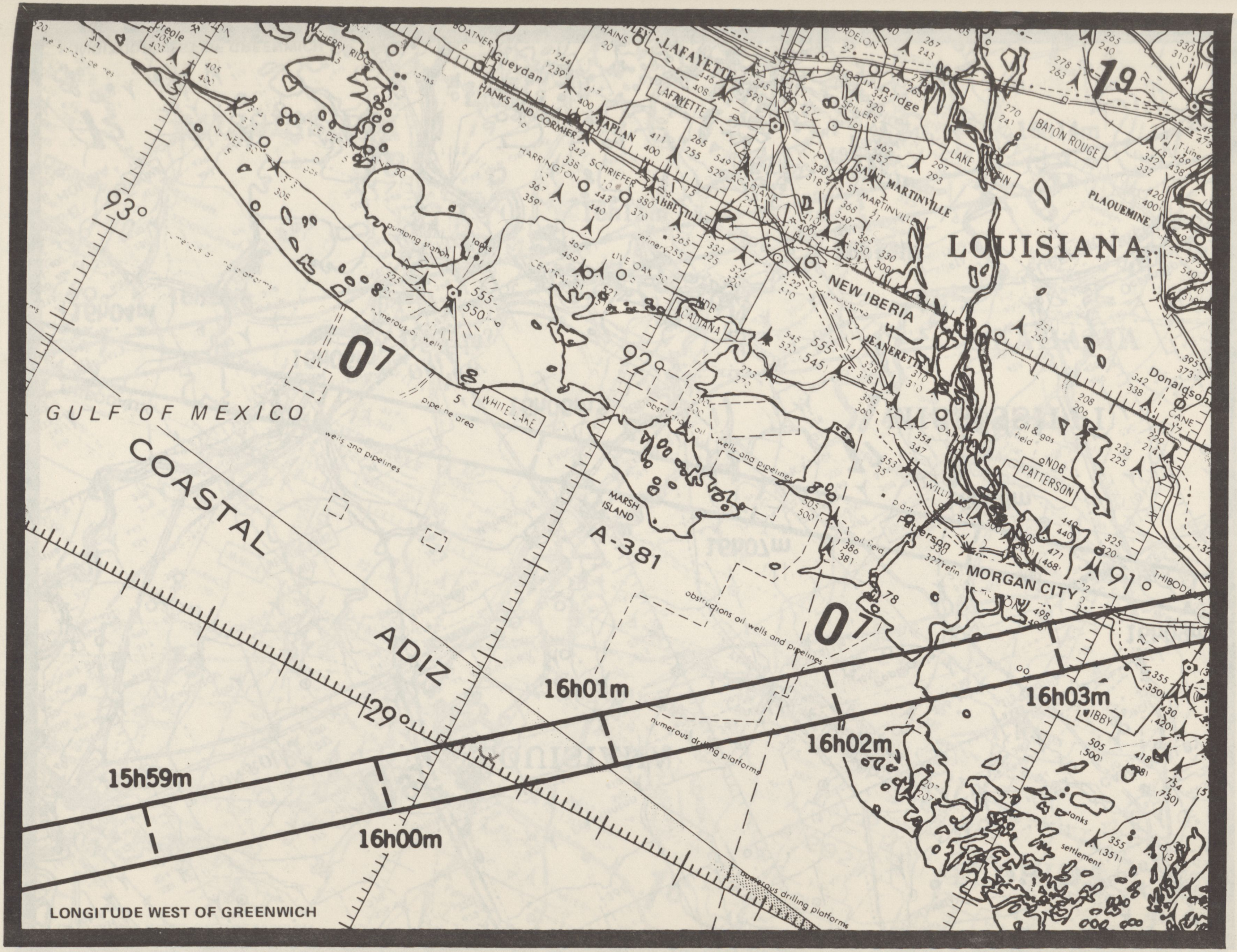

MEXICO
NORTH
PACIFIC
OCEAN
15h25m
15h26m
15h27m
15h28m
105°
20°
19°
104°
AUTLAN
MANZANILLO
COLIMA
JUCHITLAN
TENAMAXTLAN
Chamela
Cihuatlan
Tuxcacuesco
VOLCAN DE COLIMA
CIUDAD GUZMAN
LONGITUDE WEST OF GREENWICH

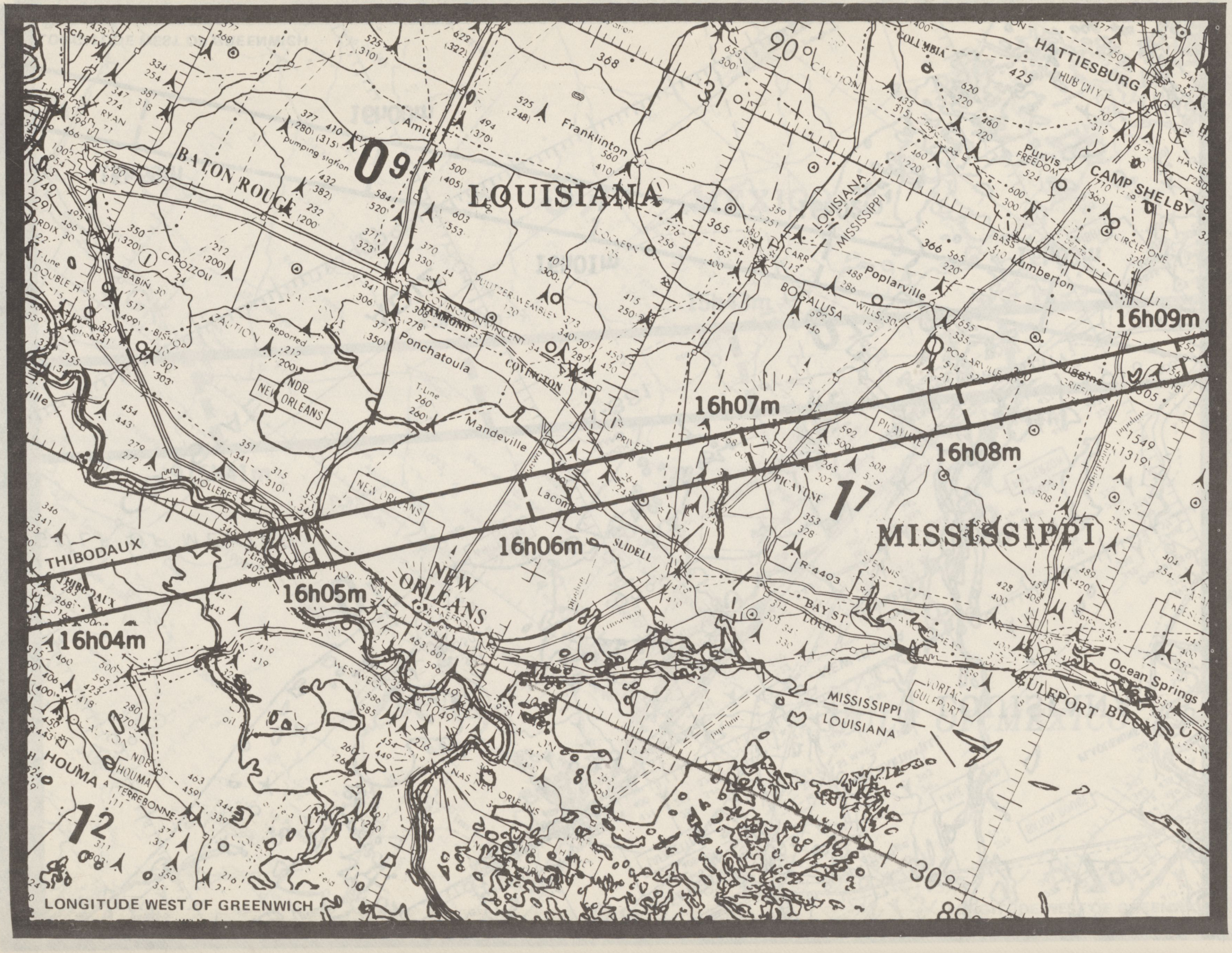

MEXICO
104°
103°
102°
21°
15h29m
15h30m
15h31m
15h32m
GUADALAJARA
SAN JUAN DE LOS LAGOS
AMECA
COCULA
AMATITAN
TEQUILA
JUCHIPILA
YAHUALICA
TEOCALTICHE
Villa Hidalgo
Nochistlan
ZACOALCO DE TORRES
CHAPALA
ATOTONILCO EL ALTO
OCOTLAN
LA BARCA
ARANDAS
TEPATITLAN DE MORELOS
SAN MIGUEL EL ALTO
CIUDAD MANUEL DOBLADO
DEGOLLADO
SAYULA
CIUDAD GUZMAN
SAHUAYO DE DIAZ
JIQUILPAN
LONGITUDE WEST OF GREENWICH

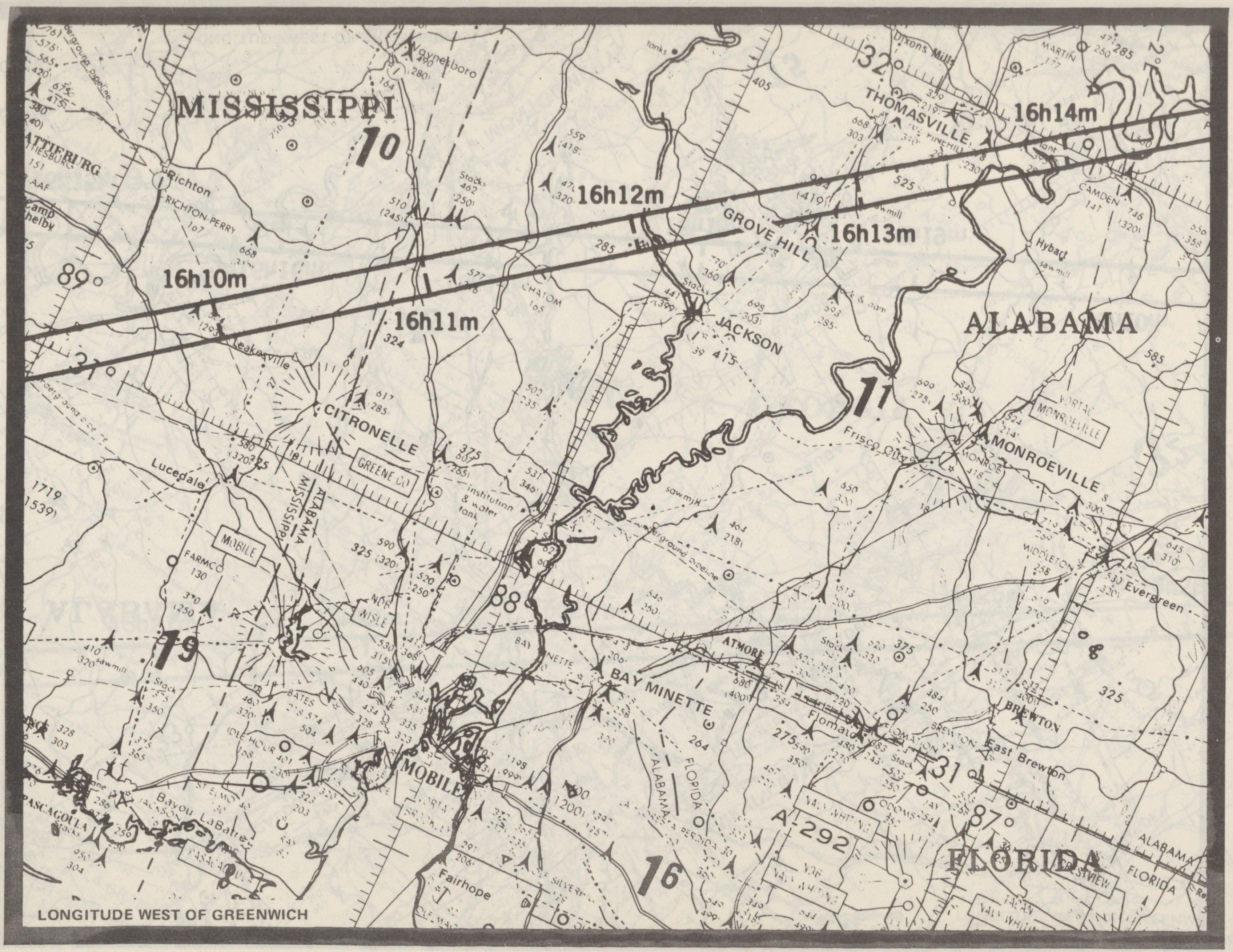

MEXICO
AGUASCALIENTES
SAN LUIS POTOSI
LAGOS DE MORENO
LEÓN
VILLA DE REYES
SANTA MARIA DEL RIO
DR. HERNANDEZ ALVAREZ
ENCARNACIÓN DE DÍAZ
15h33m
15h34m
15h35m
15h36m
102°
101°
22°
DH
EH
DG
Las Animas
Angeles
El Milagro
Viudas de Oriente
Alameda
approximate alignment
Pinos
Santa Teresa
Las Cruses
Cerrito de Zavala
Villa Hidalgo
Arista
Ojuelos de Jalisco
Villa de Arriaga
Estancia Grande
Mezquite
Ibarra
Hacienda San Pedro Almoloyan
San Francisco de Palacio
Zaragoza
Paso de San Antonio
Gallinas
Nuevo Valle de Moreno
San Diego de la Unión
Elida Villela
San José Alburquerque
SAN CARLOS
LOCKHEED-AZCARATE
pipeline
LONGITUDE WEST OF GREENWICH

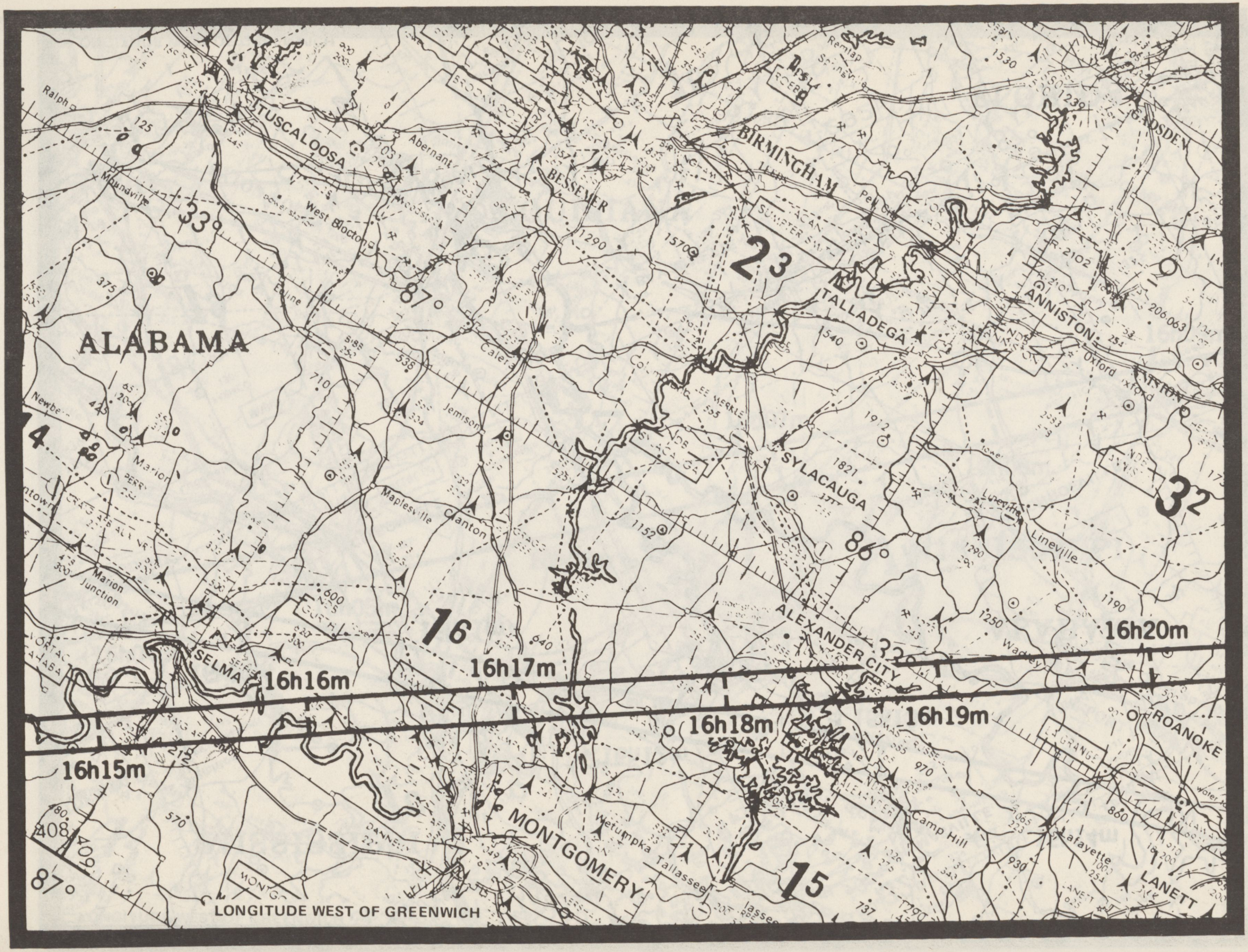

15h37m
15h38m
15h39m
15h40m
MEXICO
SIERRA
CIUDAD VICTORIA
CERRO PEÑA NEVADA
13300
23°
24°
23°
99°
100°
Doctor Arroyo
San Antonio de Peña Nevada
Santa Cruz
Jarillas
Puerto del Aire
La Presa
Vallejo
Mier y Noriega
Miquihuana
Milagro
Huizache
La Tapona
Carmen
Alberca
Verdolaga
Caracol de Álvarez
Jaumave
La Joya Verde
Palmas
San Francisco
El Sauz
Santa María de Guadalupe
Presa de Guadalupe
Charco Blanco
Qelital
CERRITOS
San Antonio
La Cruces
Ejido Palomas
San Bartolo
Angostura
Colonia Agrícola Marita
CIUDAD DEL MAIZ
Capelita
Palo Blanco
Nuevo Morelos
Ocampo
CIUDAD DEL MANTE
Xicotencatl
XICOTENCATL
La Reforma
Llera
Santa Fe
Carillo Puerto (Ejido)
Estación Forlón
Estación Escandón
Estación Calles
Las Nigüas
San Francisco
Lavín
Tinajas
El Carmen
San Pedro
Caballeros
Santa Rosa
LONGITUDE WEST OF GREENWICH

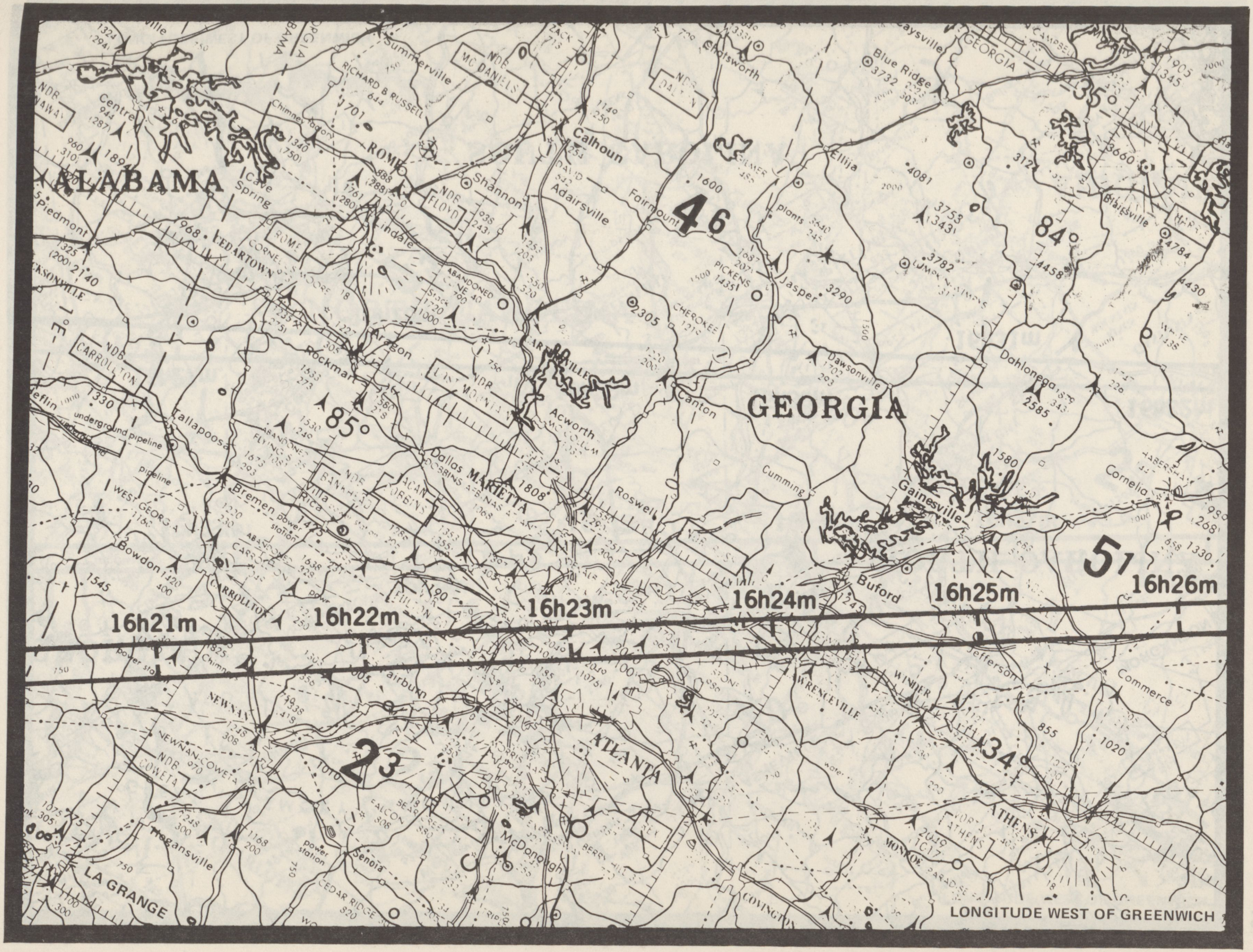

MEXICO
GULF OF MEXICO
15h41m
15h42m
15h43m
15h44m
99°
98°
97°
24°
GK
HK
LONGITUDE WEST OF GREENWICH
CAUTION
Vertical errors
of 2000 feet
reported
San Carlos
San Nicolas
Carricito
San Fernando
Santa Teresa
Los Encinitos
La Pitahaya
El Barreta
Tres Palos
Jiménez
Abasolo
La Capilla
Corredero
Villa de Casas
Santa Teresa
Esperanza
San Juan
Baloncitos
La Noria
Ejido La Peña
Ejido El Saladito
El Sauz
La Aguita
El Verde
Santa Rosa
SANTA ROSA EAST
RANCHO TRES MARIAS
RANCHO BUENAVISTA
RANCHO TANGUMA
Santa Maria
LA PESCA
La Piedra
Tres de Mayo
La Coma
La Peña
Ejido Los Lavaderos
Temascal
Ejido Morales

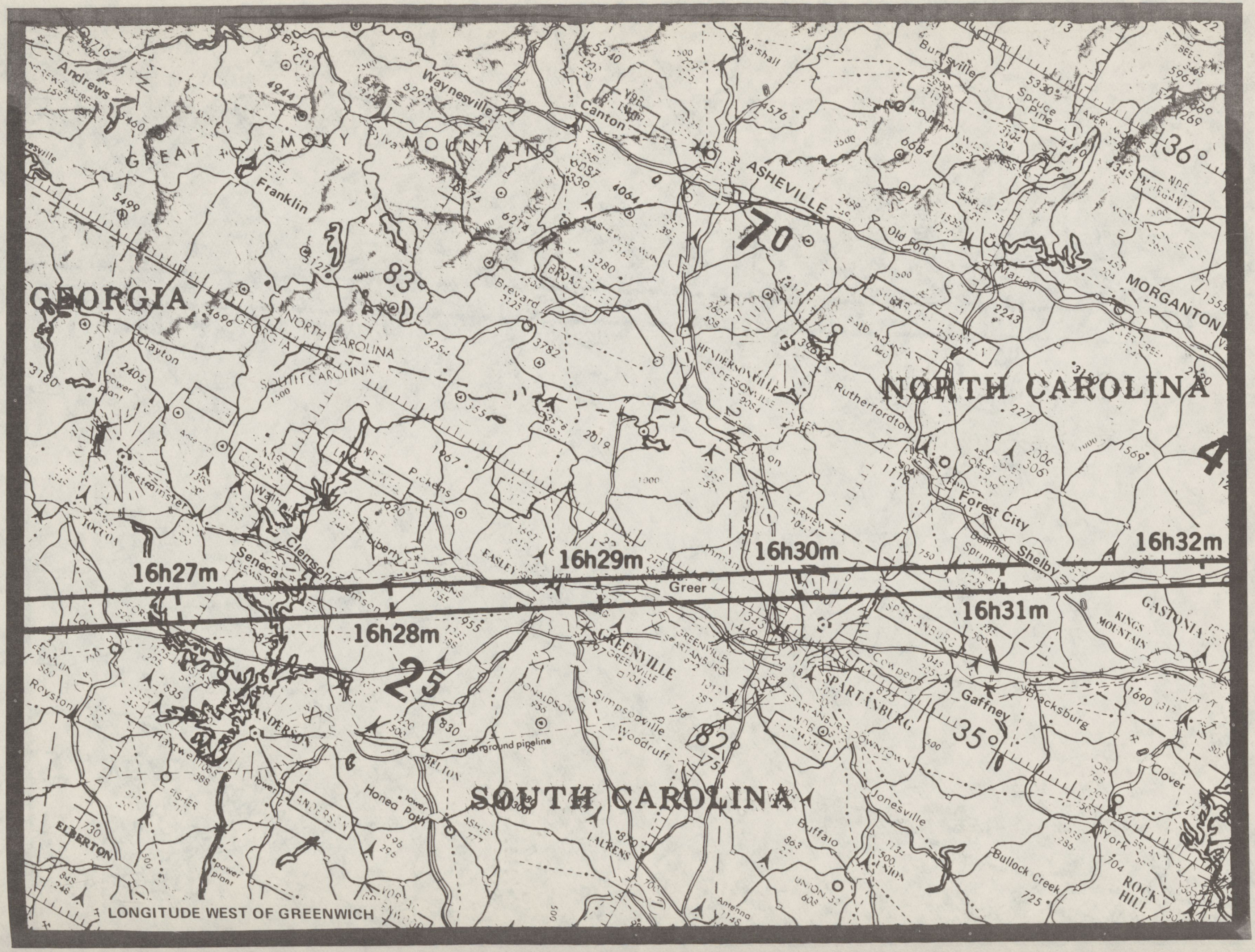

LOUISIANA
GULF OF MEXICO
COASTAL ADIZ
A-381
93°
92°
91°
29°
15h59m
16h00m
16h01m
16h02m
16h03m
LAFAYETTE
Gueydan
KAPLAN
ABBEVILLE
Breaux Bridge
SAINT MARTINVILLE
NEW IBERIA
JEANERETTE
LAKE MARTIN
BATON ROUGE
PLAQUEMINE
Donaldsonville
WHITE LAKE
ACADIANA
PATTERSON
MORGAN CITY
MARSH ISLAND
numerous oil wells
wells and pipelines
obstructions oil wells and pipelines
numerous drilling platforms
07
07
19
LONGITUDE WEST OF GREENWICH

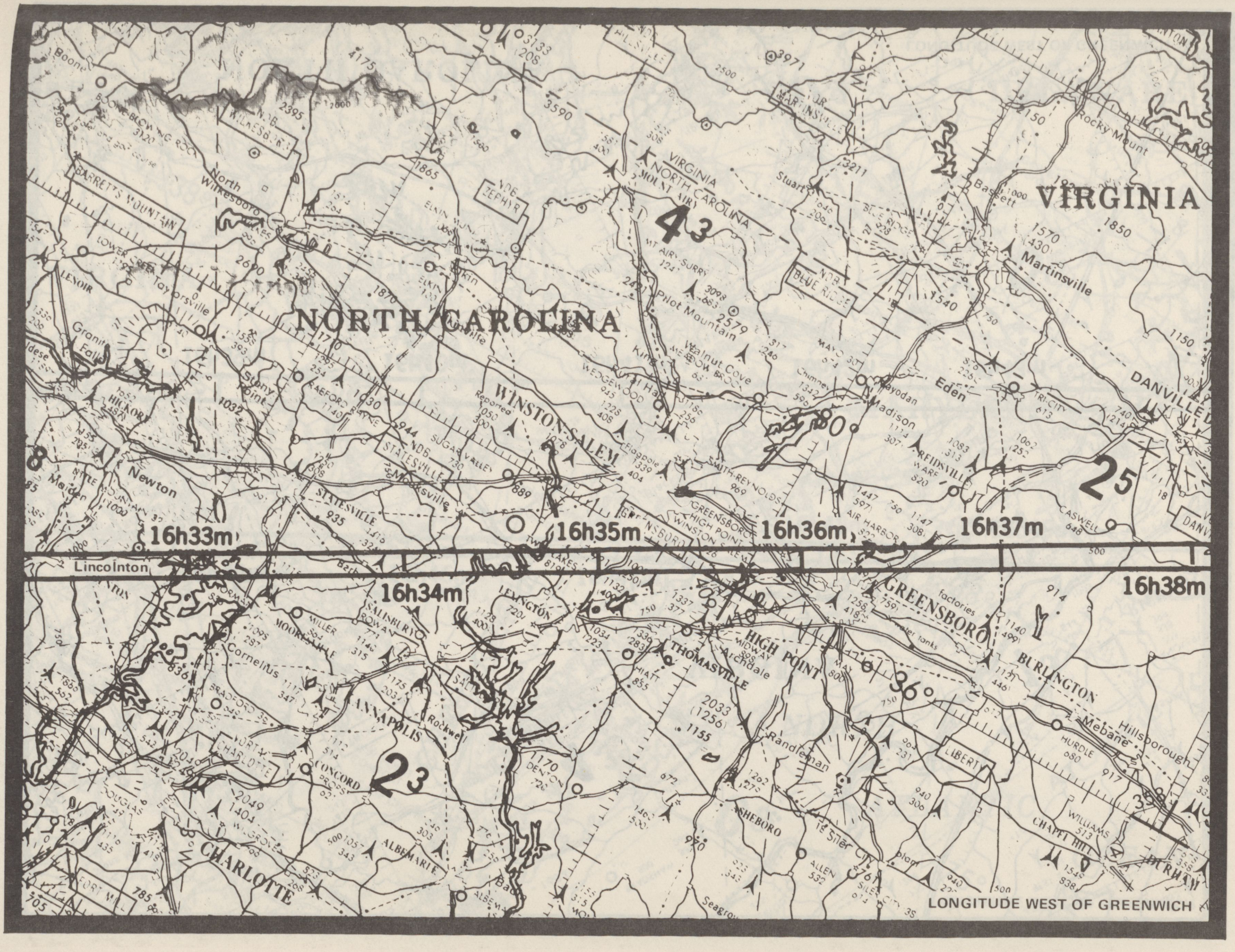

16h04m
16h05m
16h06m
16h07m
16h08m
16h09m
LOUISIANA
MISSISSIPPI
BATON ROUGE
NEW ORLEANS
THIBODAUX
HOUMA
TERREBONNE
Ponchatoula
Mandeville
SLIDELL
Lacombe
Amite
Franklinton
Covington
BOGALUSA
Poplarville
PICAYUNE
BAY ST. LOUIS
GULFPORT
BILOXI
Ocean Springs
Lumberton
Purvis
HATTIESBURG
CAMP SHELBY
COLUMBIA
WESTWEGO
90°
89°
31°
30°
LONGITUDE WEST OF GREENWICH

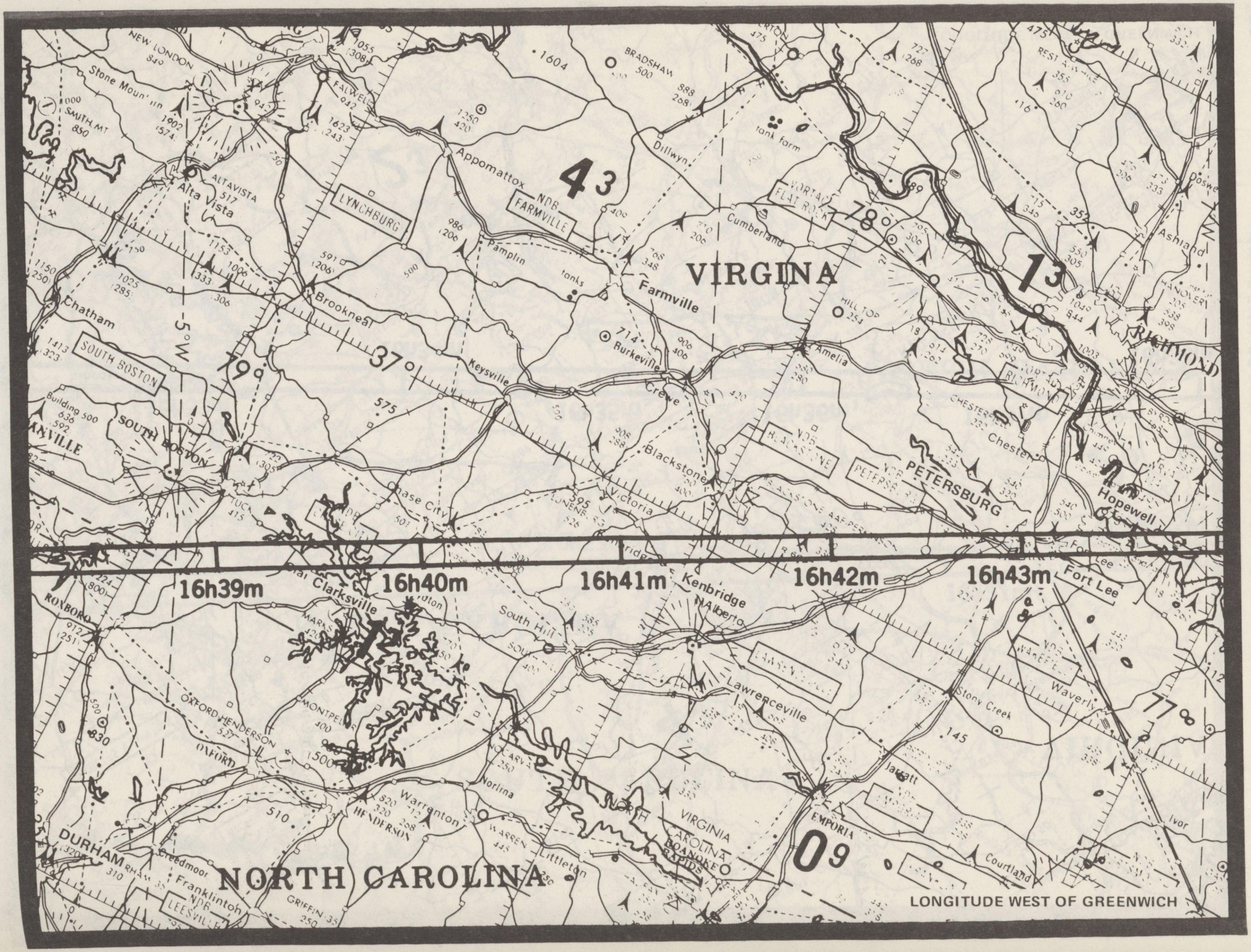

MISSISSIPPI
ALABAMA
FLORIDA
16h10m
16h11m
16h12m
16h13m
16h14m
32°
31°
89°
88°
87°
Waynesboro
Richton
Leakesville
Lucedale
Citronelle
Thomasville
Grove Hill
Jackson
Monroeville
Frisco City
Evergreen
Atmore
Bay Minette
Flomaton
Brewton
East Brewton
Mobile
Fairhope
Pascagoula
Bayou La Batre
Camden
Hybart
Chatom
Dixons Mills
LONGITUDE WEST OF GREENWICH

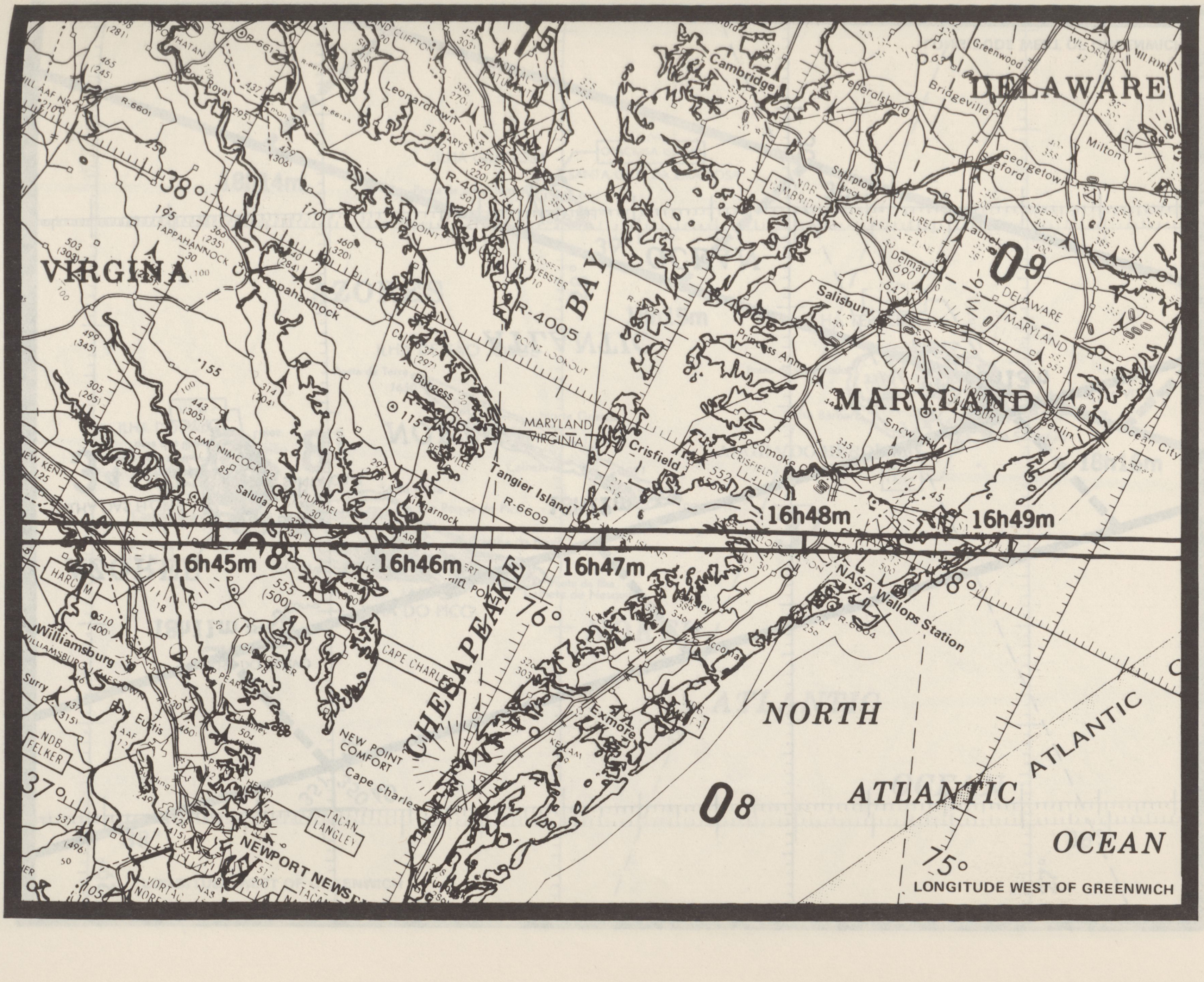

ALABAMA
TUSCALOOSA
BIRMINGHAM
BESSEMER
GADSDEN
TALLADEGA
ANNISTON
SYLACAUGA
ALEXANDER CITY
SELMA
MONTGOMERY
ROANOKE
LANETT
33°
32°
87°
86°
16h15m
16h16m
16h17m
16h18m
16h19m
16h20m
LONGITUDE WEST OF GREENWICH

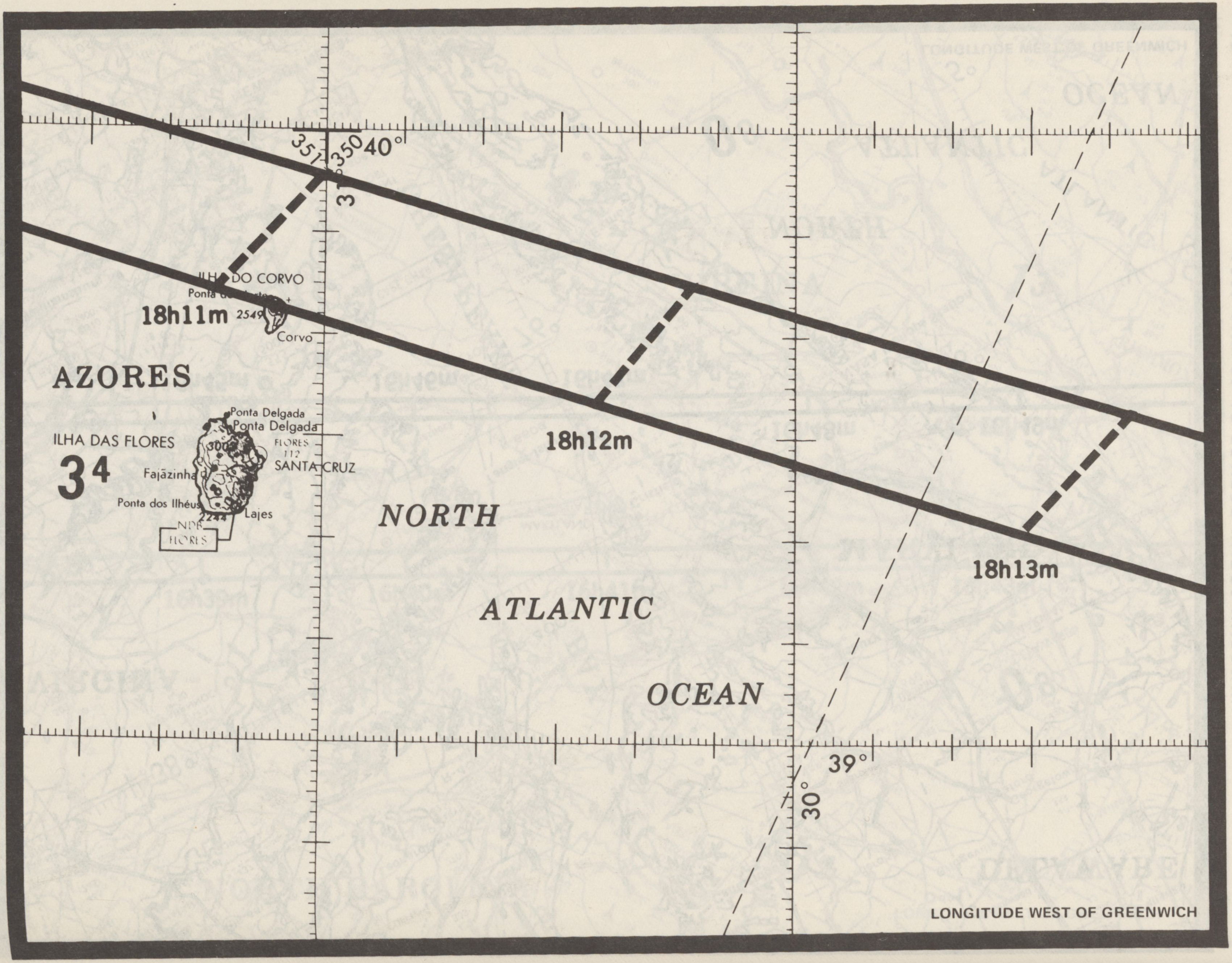

ALABAMA
GEORGIA
16h21m
16h22m
16h23m
16h24m
16h25m
16h26m
85°
84°
35°
34°
Rome
Calhoun
Chatsworth
Summerville
Blue Ridge
Ellija
Blairsville
Jasper
Cedartown
Rockmart
Aragon
Cartersville
Adairsville
Shannon
Fairmount
Canton
Dawsonville
Dahlonega
Cornelia
Gainesville
Cumming
Roswell
Acworth
Marietta
Dallas
Tallapoosa
Bremen
Villa Rica
Carrollton
Bowdon
Buford
Jefferson
Commerce
Winder
Lawrenceville
Atlanta
Fairburn
Newnan
McDonough
Senoia
Hogansville
La Grange
Athens
Monroe
Covington
Piedmont
Centre
Heflin
LONGITUDE WEST OF GREENWICH

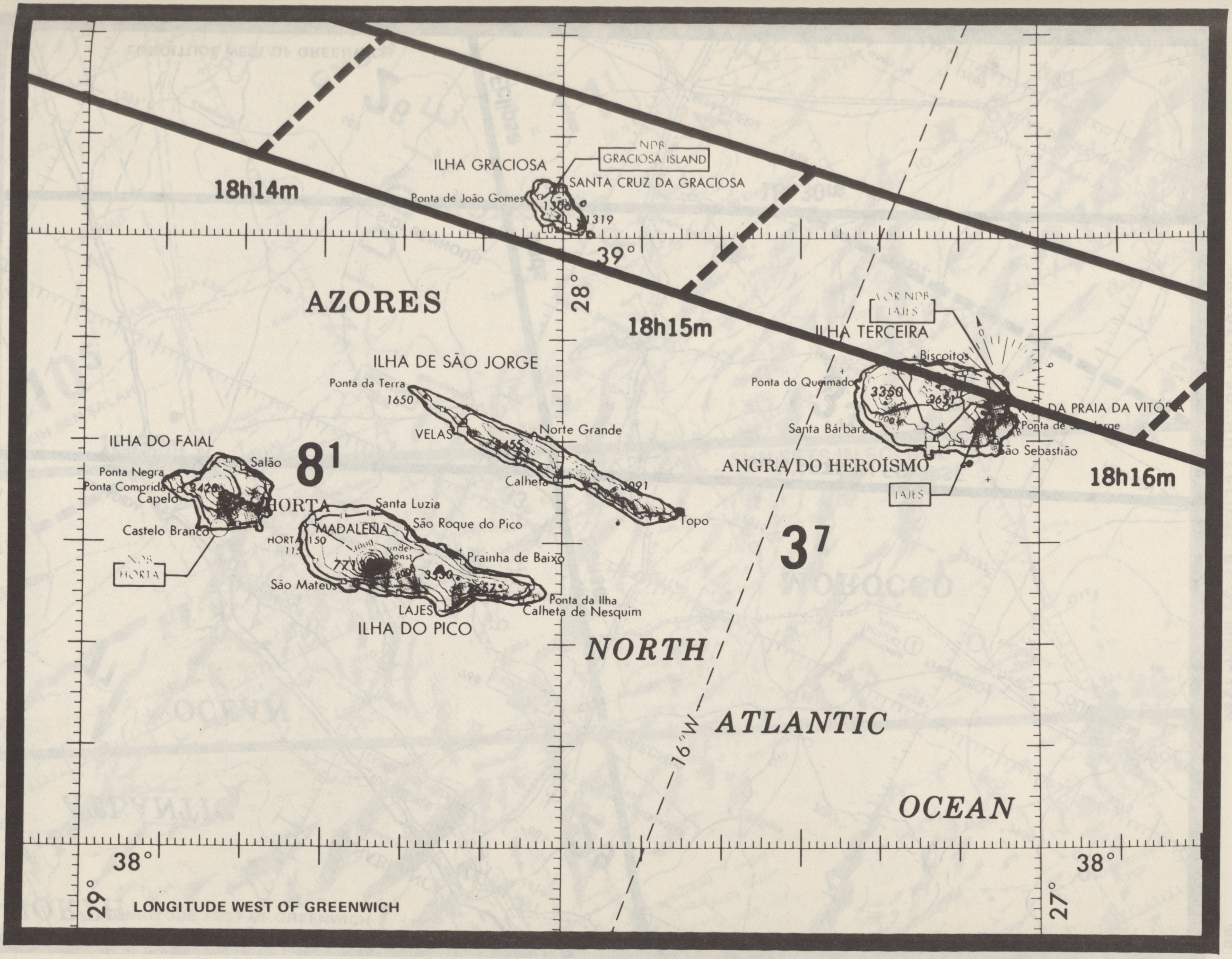

16h27m
16h28m
16h29m
16h30m
16h31m
16h32m
GEORGIA
NORTH CAROLINA
SOUTH CAROLINA
GREAT SMOKY MOUNTAINS
36°
35°
83°
82°
70
25
ASHEVILLE
Waynesville
Canton
Franklin
Brevard
Hendersonville
Rutherfordton
Forest City
Shelby
MORGANTON
Marion
Burnsville
Spruce Pine
Clayton
Westminster
Toccoa
Walhalla
Clemson
Seneca
Pickens
Easley
Greer
GREENVILLE
SPARTANBURG
Gaffney
Blacksburg
Kings Mountain
GASTONIA
Clover
ROCK HILL
York
Royston
Hartwell
ANDERSON
Belton
Honea Path
Simpsonville
Woodruff
Laurens
Buffalo
Jonesville
Union
Bullock Creek
ELBERTON
Andrews
LONGITUDE WEST OF GREENWICH

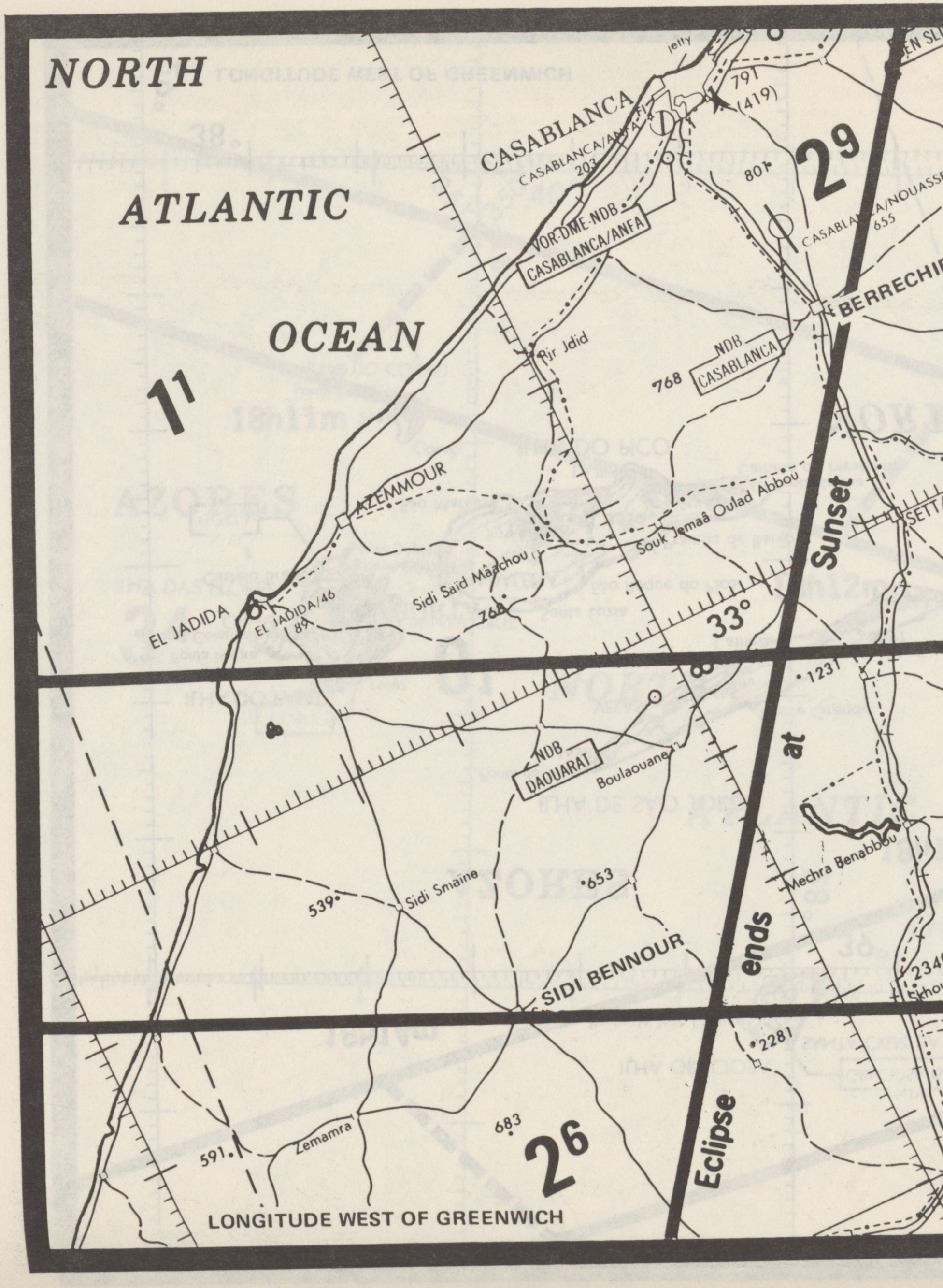

VIRGINIA
NORTH CAROLINA
16h33m
16h34m
16h35m
16h36m
16h37m
16h38m
Lincolnton
WINSTON-SALEM
GREENSBORO
HIGH POINT
THOMASVILLE
BURLINGTON
CHARLOTTE
STATESVILLE
Martinsville
DANVILLE
Eden
Madison
Pilot Mountain
Mebane
Hillsborough
DURHAM
CHAPEL HILL
Newton
HICKORY
North Wilkesboro
Rocky Mount
LONGITUDE WEST OF GREENWICH

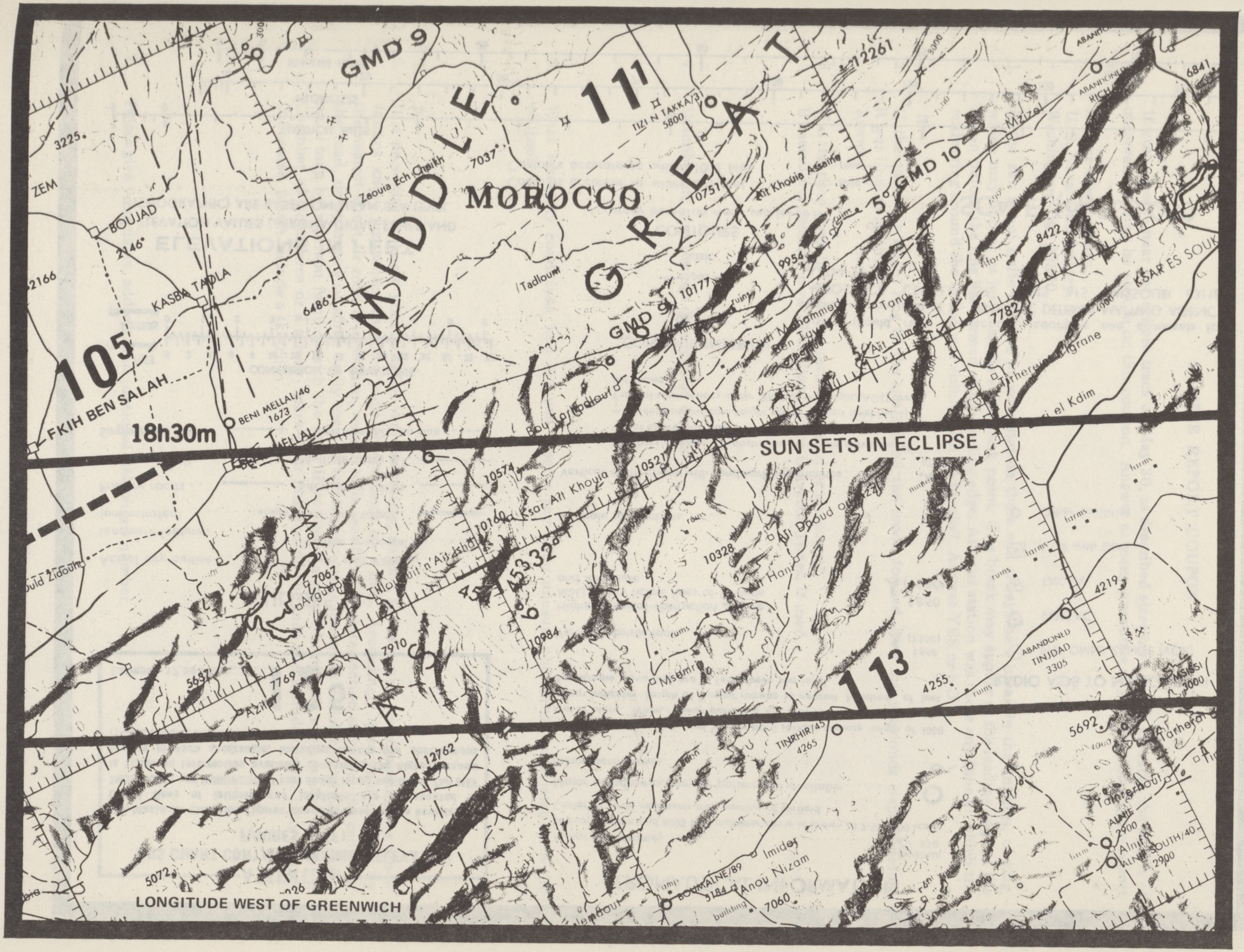

VIRGINA
NORTH CAROLINA
16h39m
16h40m
16h41m
16h42m
16h43m
LONGITUDE WEST OF GREENWICH
37°
79°
78°
77°
5°W
43
13
09
Lynchburg
Appomattox
Farmville
Alta Vista
Brookneal
Chatham
South Boston
Keysville
Burkeville
Crewe
Blackstone
Victoria
Chase City
Amelia
Cumberland
Dillwyn
Pamplin
Richmond
Petersburg
Chester
Hopewell
Ashland
Fort Lee
Clarksville
Kenbridge
Alberta
South Hill
Lawrenceville
Stony Creek
Waverly
Jarratt
Emporia
Courtland
Ivor
Oxford
Henderson
Warrenton
Norlina
Littleton
Roanoke Rapids
Creedmoor
Franklinton
Durham
Roxboro
Danville


DELAWARE
VIRGINIA
MARYLAND
CHESAPEAKE
BAY
NORTH
ATLANTIC
OCEAN
ATLANTIC
16h45m
16h46m
16h47m
16h48m
16h49m
38°
37°
76°
75°
0 9
0 8
Cambridge
Salisbury
Crisfield
Tangier Island
NASA Wallops Station
Ocean City
Berlin
Snow Hill
Williamsburg
NEWPORT NEWS
Cape Charles
NEW POINT COMFORT
Exmore
Tappahannock
Saluda
Kilmarnock
Leonardtown
Georgetown
Seaford
Milton
Bridgeville
Delmar
Princess Anne
MARYLAND VIRGINIA
LONGITUDE WEST OF GREENWICH


351
350
40°
31
ILHA DO CORVO
Ponta do
2549
Corvo
18h11m
AZORES
Ponta Delgada
Ponta Delgada
ILHA DAS FLORES
3⁴
300
FLORES
112
SANTA CRUZ
Fajãzinha
Ponta dos Ilhéus
2244
Lajes
NDB
FLORES
18h12m
NORTH
ATLANTIC
OCEAN
18h13m
39°
30°
LONGITUDE WEST OF GREENWICH


18h14m
18h15m
18h16m
NDB
GRACIOSA ISLAND
ILHA GRACIOSA
SANTA CRUZ DA GRACIOSA
Ponta de João Gomes
1308
1319
39°
28°
AZORES
VOR NDB
LAJES
ILHA TERCEIRA
Biscoitos
Ponta do Queimado
3350
2651
1000
DA PRAIA DA VITÓRIA
Santa Bárbara
Ponta de São Jorge
São Sebastião
ANGRA DO HEROÍSMO
LAJES
ILHA DE SÃO JORGE
Ponta da Terra
1650
VELAS
Norte Grande
3455
Calheta
3091
Topo
ILHA DO FAIAL
Salão
Ponta Negra
Ponta Comprida
Capelo
3420
HORTA
Castelo Branco
NDB
HORTA
8¹
Santa Luzia
São Roque do Pico
MADALENA
HORTA 150
115
under const
Prainha de Baixo
7711
3530
São Mateus
LAJES
Ponta da Ilha
Calheta de Nesquim
ILHA DO PICO
3⁷
NORTH
ATLANTIC
OCEAN
16°W
38°
38°
29°
27°
LONGITUDE WEST OF GREENWICH


NORTH
ATLANTIC
OCEAN
1¹
CASABLANCA
CASABLANCA/ANFA
203
VOR-DME-NDB CASABLANCA/ANFA
791
(419)
801
29
CASABLANCA/NOUASSER
655
BERRECHID
NDB CASABLANCA
768
Bir Jdid
BEN SLIMANE
El Gara
2267
2950
3075
OUED ZEM/65
2756
OUED ZEM
BEN AHMED
ruins
2628
KHOURIBGA
ABANDONED M'RIZIG 2560
KHOURIBGA 2552
MOROCCO
AZEMMOUR
Souk Jemaâ Oulad Abbou
SETTAT
Sidi Saïd Mâachou
EL JADIDA
EL JADIDA/46
89
768
33°
Sunset
2015
shrine
2327
SUN SETS IN ECLIPSE
FKIH BEN SALAH
1231
NDB DAOUARAT
Boulaouane
at
3³
Dar Chafai
El Borouj
1464
1286
Mechra Benabbou
539
Sidi Smaine
653
SIDI BENNOUR
ends
2340
Skhour des Rehamna
1674
18h30m
2281
1828
Eclipse
KELAA DES SERARHNA
EL KELAA DES SRARHNA/55
1550
591
Zemamra
683
26
BEN GUERIR
GMD 7B
2609
LONGITUDE WEST OF GREENWICH


GMD 9
MIDDLE
MOROCCO
GREAT
ATLAS
11¹
10⁵
11³
18h30m
SUN SETS IN ECLIPSE
5° GMD 10
GMD 9
6°
45
32°
LONGITUDE WEST OF GREENWICH
ZEM
3225.
BOUJAD
2146°
2166
KASBA TADLA
6486°
FKIH BEN SALAH
BENI MELLAL/46
1673
Ould Zidoun
Zaouia Ech Cheikh
7037°
TIZI N TAKKA/3
5800
10751°
Ait Khouia Assaine
9954
10177
12261
Tadlount
Sidi Mohammed
Ait Slimane
7782
KSAR ES SOUK
8422
MZIZEL
ABANDONED RICH
6841
Tarhersa
Tigrane
el Kdim
10574
10521
10160
Ksar Ait Khouia
Ait Daoud
10328
7067
Arguen
7910
7769
5637
10984
Msemrir
TINRHIR/45
4265
4255.
ABANDONED TINJDAD
3305
4219
5692
ERRACHIDIA/MSISSI
3000
ALNIF
2900
ALNIF SOUTH/40
2900
12762
5072
Imider
Anou Nizam
BOUMALNE/89
5184
7060
farms
ruins

ATTENTION

THIS CHART CONTAINS MAXIMUM ELEVATION FIGURES (MEF)

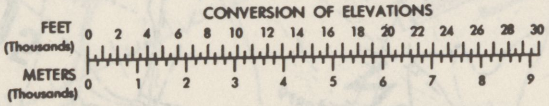
The Maximum Elevation Figures shown in quadrangles bounded by ticked lines of latitude and longitude are represented in THOUSANDS and HUNDREDS of feet above mean sea level. The MEF is based on information available concerning the highest known feature in each quadrangle, including terrain and obstructions (trees, towers, antennas, etc.)

Example: 12,500 feet....... 12^5

CULTURE

Actual city outline ......
Towns and Villages (outline unknown) ...... □ ▫
Landmark features (unillustrated) .... • ranch
Dual lane roads .. ═══
Primary roads .... ───
Secondary roads . ───
Tracks and trails.. — — —
Multiple track R.R.
Single track R.R....
Power transmission line •-----•

CONVERSION OF ELEVATIONS



ELEVATIONS IN FEET

ALL ELEVATION VALUES (AERONAUTICAL, RELIEF AND HYDROGRAPHIC) ARE BASED ON MEAN SEA LEVEL.

AERONAUTICAL INFORMATION

Major aerodromes.. J EDNA 920
Runway pattern and 6000 foot diameter circle is shown at 1:500,000 scale. Center of circle represents true position of airfield.

Major aerodromes, runway pattern not available............ ○

Minor aerodromes.. ○

Major aerodromes portrayed have a hard surface runway length of 3000 feet or more. When runway pattern is not shown, number following the name indicates length of longest runway to nearest hundreds of feet. Aerodrome elevations are in feet above sea level.

Vertical obstructions............................. 1850 (1250)

Highest vertical obstruction (above MSL) within ticked lines of latitude and longitude............................. 1850 (1250)

Multiple obstructions.............................

Vertical obstructions with landmark significance............ 920 (230)

Numbers adjacent to obstruction indicate elevation of top of obstruction above mean sea level (MSL). Numerals in parentheses indicate height above ground level (AGL). Vertical obstructions under 200 feet in height (AGL) are not shown.

RADIO AIDS TO NAVIGATION

VHF OMNI RANGE (VOR)
VORTAC
TACAN
VOR with DME
Other Facilities

CONTOUR INTERVAL

1000 feet

——1000——
Basic

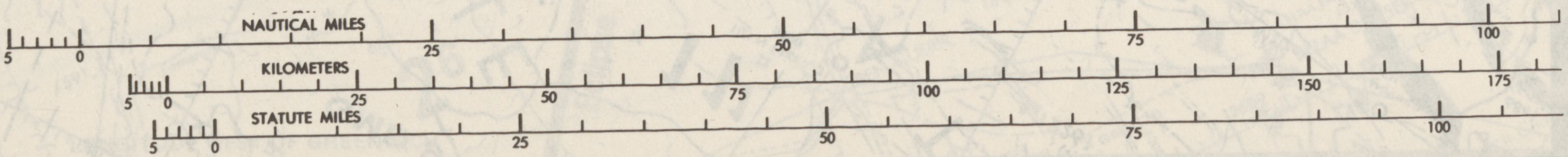
CONTOURS

(Accuracy based on mean sea level)

Contours accurate to within 500 feet ...... ——1000——
Contours accurate to within 1000 feet ..... — —1000— —

Users should refer corrections, additions and comments for improving this product to: DIRECTOR, DEFENSE MAPPING AGENCY AEROSPACE CENTER. ST. LOUIS AFS, MISSOURI 63118. ATTN: PP

SCALE 1:1,000,000



ECLIPSE REPORT COUPON

If you observe near the eclipse track on May 30, as described elsewhere in this Circular, the report of your observations may be sent in on this coupon. Answer as many questions as you can. Send your report to:

Eclipse Observations,
U. S. Naval Observatory, NAO,
Washington, DC 20390.

1. If the sun is not quite eclipsed at your station there will always be a break in the annulus, or ring, which may appear as just a single small dark point. One break may appear at the leading edge of the moon before the ring has formed at the trailing edge. At your station was there any time at which the entire ring around the moon was visible with no breaks? Answer YES or NO.

2. If the complete bright ring of the sun around the moon formed, how many seconds elapsed before it was broken again?
Answer: Seconds.

3. Was the time given in the last question guessed or measured?
If measured, describe how. Give Standard or Universal Times, if used.

4. Describe and give timings on any bead events.

5. What were sky conditions, and did you observe any other unusual phenomena associated with the eclipse?

6. It is necessary to know your position very accurately, so that the astronomers compiling the observations know just where to place your observations on a map. Accordingly, give your position by the nearest street or road intersection, measured in feet from the intersection and from the center of the road, or by means of some easily located building or other landmark which can be placed easily on a map by a person familiar with the area. If you have a map of the area, such as provided by a Chamber of Commerce or a survey, mark your position on the map and include it with your report. Otherwise, please include a sketch.

7. Please give your name, address, and (optional) telephone number.